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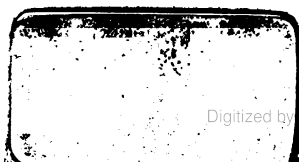
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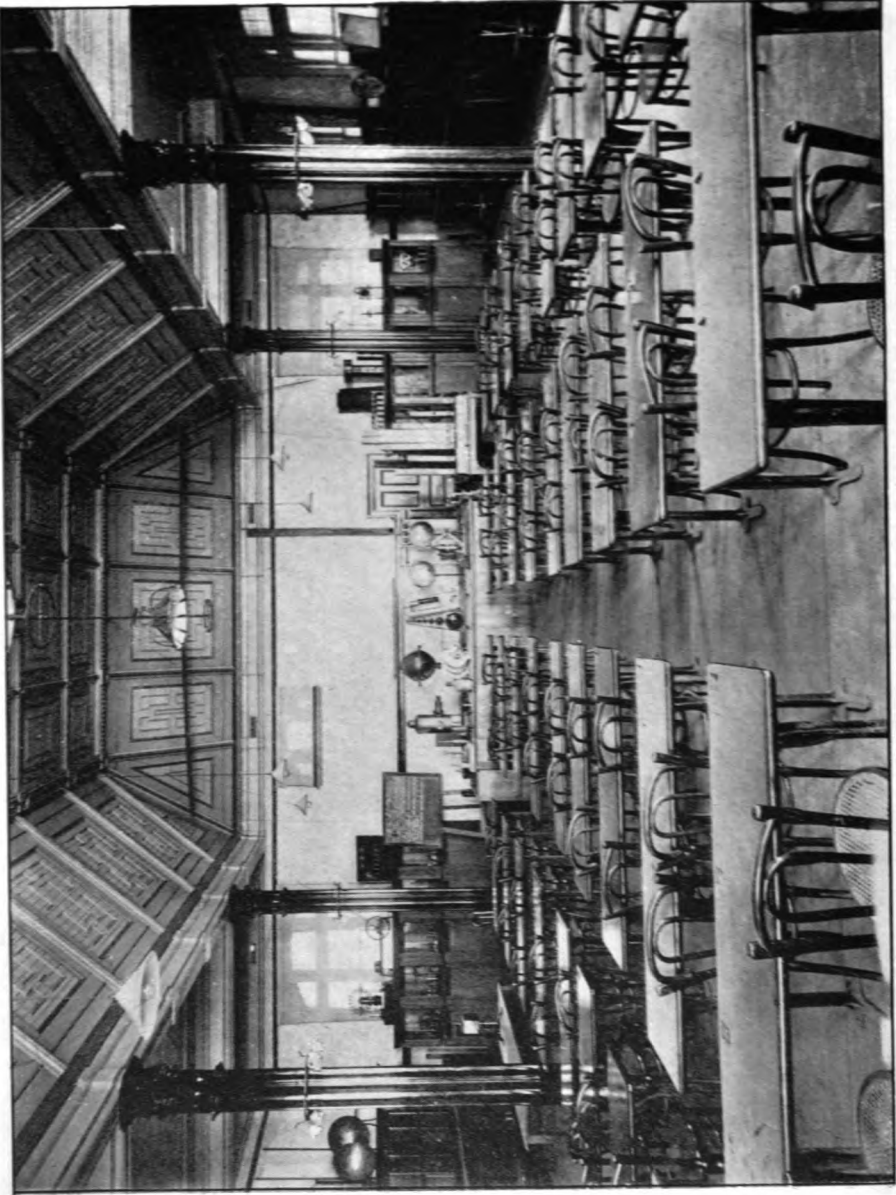


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New South Wales

SSM



LECTURE HALL.

DEPARTMENT OF PUBLIC INSTRUCTION,
NEW SOUTH WALES.

TECHNICAL EDUCATION BRANCH.

CALENDAR, 1897,

GIVING DETAILS OF THE COURSE OF INSTRUCTION FOR EACH CLASS IN THE

SYDNEY TECHNICAL COLLEGE

AND

BRANCH SCHOOLS,

AND PARTICULARS AS TO

THE TECHNOLOGICAL MUSEUMS.



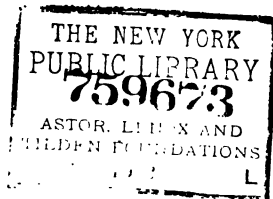
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1897.

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Department of Public Instruction,

NEW SOUTH WALES.

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Under Secretary: J. C. MAYNARD.

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TECHNICAL EDUCATION BRANCH.

Superintendent: R. N. MORRIS, LL.D.

Registrar: GEORGE HOOPER.

Sydney Technical College.

OFFICE HOURS:—Monday to Friday, 9 a.m. to 8 p.m.; Saturday, 9 a.m. to 12 noon.
During Vacation, 9 a.m. to 4.30 p.m. The Offices are closed on Public Holidays.

The Reference Library at the College—containing several thousands of volumes and the latest technical periodicals—is open to Teachers and Students from 9 to 11 a.m., 1 to 4.30 p.m., and from 6 p.m. to 9 p.m., from Monday to Friday; and on Saturdays from 10 to 12 noon.

In addition to the teaching staff enumerated under the respective Syllabuses, the Rev. J. MILNE CURRAN, F.G.S., is Travelling Lecturer in Geology and Mineralogy.

Applications for the services of this Lecturer, as well as for those of the Lecturer in Agriculture, should be addressed to this office.

Sydney Technological Museum.

Assistant Curator: R. T. BAKER, F.L.S.

The Museum is open to the public during every week-day and Sunday afternoon of the year (except Good Friday and Christmas Day)—Week days, 1 to 5 p.m. The hours on Sundays are from 2 to 5 p.m.

JANUARY—xxxI.

1897.

FEBRUARY—xxvIII.

1	F	NEW YEAR'S DAY.	1	M	Wool-classing instruction commences. Enrolment of Students begins.
2	S		2	Tu	
3	S		3	W	
4	M		4	Th	
5	Tu		5	F	
6	W		6	S	
7	Th		7	S	
8	F		8	M	
9	S		9	Tu	
10	S		10	W	
11	M	Entries received for Technological Examinations of the City and Guilds of London Institute.	11	Th	Vacation ends. First Term begins. Opening of Tech. Coll., Ultimo, 1892.
12	Tu		12	F	
13	W		13	S	
14	Th		14	S	
15	F		15	M	
16	S		16	T	
17	S		17	W	
18	M		18	Th	
19	Tu		19	F	
20	W		20	S	
21	Th	ANNIVERSARY DAY. Annual Exhibition of Works of Students.	21	S	
22	F		22	M	
23	S		23	Tu	
24	S		24	W	
25	M		25	Th	
26	Tu		26	F	
27	W		27	S	
28	Th		28	S	
29	F				
30	S				
31	S				

MARCH—xxxI.

APRIL—xxx.

1	M	Opening of Workshops at Ultimo, 1891.	1	Th	Entries close for City and Guilds of London Institute Examinations.
2	Tu		2	F	
3	W		3	S	
4	Th		4	S	
5	F		5	M	
6	S		6	Tu	
7	S		7	W	
8	M		8	Th	
9	Tu		9	F	
10	W	Half Term.	10	S	Practical Examinations of the City and Guilds of London Institute held in Plumbing, &c.
11	Th		11	S	
12	F		12	M	
13	S		13	Tu	
14	S		14	W	
15	M		15	Th	
16	Tu		16	F	
17	W		17	S	
18	Th		18	S	
19	F		19	M	
20	S	Technological Examinations of the City and Guilds of London Insti- tute held.	20	Tu	
21	S		21	W	
22	M		22	Th	
23	Tu		23	F	
24	W		24	S	
25	Th		25	S	
26	F		26	M	
27	S		27	Tu	
28	S		28	W	
29	M		29	Th	
30	Tu		30	F	
31	W				

MAY—xxxI.			JUNE—xxx.		
1	S		1	Tu	Erection of Technical College Ultimo (Tenders accepted.)—1890.
2	S		2	W	
3	M		3	Th	
4	Tu		4	F	
5	W		5	S	
6	Th		6	S	
7	F		7	M	
8	S		8	Tu	
9	S		9	W	
10	M		10	Th	
11	Tu		11	F	
12	W		12	S	
13	Th		13	S	
14	F		14	M	
15	S	First Term ends.	15	Tu	Public Holiday.—Classes close.
16	S	Second Term begins.	16	W	
17	M		17	Th	
18	Tu		18	F	
19	W		19	S	
20	Th		20	S	
21	F		21	M	
22	S		22	Tu	
23	S		23	W	
24	M	QUEEN'S BIRTHDAY.—Classes close.	24	Th	
25	Tu	25	F		
26	W	26	S		
27	Th	27	S		
28	F	28	M		
29	S	29	Tu		
30	S	30	W		
31	M				
JULY—xxxI.			AUGUST—xxxI.		
1	Th	Half Term.	1	S	Public Holiday.—Classes close.
2	F		2	M	
3	S		3	Tu	
4	S		4	W	
5	M		5	Th	
6	Tu		6	F	
7	W		7	S	
8	Th		8	S	
9	F		9	M	
10	S		10	Tu	
11	S		11	W	
12	M		12	Th	
13	Tu		13	F	
14	W		14	S	
15	Th	Arbor Day inaugurated (1890).	15	S	Official opening of Technological Museum, Ultimo, 1893. Trustees of Australian Museum took first steps towards formation of Technological Museum, 1878. First sum (£2,000) voted by Parlia- ment for Technical Education (1878).
16	F		16	M	
17	S		17	Tu	
18	S		18	W	
19	M		19	Th	
20	Tu		20	F	
21	W		21	S	
22	Th		22	S	
23	F		23	M	
24	S		24	Tu	
25	S		25	W	
26	M		26	Th	
27	Tu		27	F	
28	W		28	S	
29	Th		29	M	Second Term ends.
30	F		30	S	
31	S	Wool-classing instruction ends.	31	Tu	
					Third Term begins.

SEPTEMBER—xxx.			OCTOBER—xxxI.		
1	W	<p>Garden Palace Fire, 1882. First Technological Museum collection destroyed.</p> <p>Rail to Parramatta opened 1855.</p>	1	F	Board of Technical Education app'nted(1883).
2	Th		2	S	
3	F		3	S	
4	S		4	M	Eight-Hour Demonstration.—Classes close.
5	S		5	Tu	
6	M		6	W	
7	Tu		7	Th	
8	W		8	F	
9	Th		9	S	
10	F		10	S	Half Term.
11	S		11	M	
12	S		12	Tu	
13	M		13	W	
14	Tu		14	Th	
15	W		15	F	
16	Th		16	S	
17	F		17	S	
18	S		18	M	
19	S		19	Tu	
20	M		20	W	
21	Tu		21	Th	
22	W		22	F	
23	Th		23	S	
24	F		24	S	
25	S		25	M	
26	S		26	Tu	
27	M		27	W	
28	Tu		28	Th	
29	W		29	F	
30	Th		30	S	
			31	S	
NOVEMBER—xxx.			DECEMBER—xxxI.		
1	M	<p>Board of Technical Education dissolved (1889).</p> <p>Technical Education Branch transferred to Department of Public Instruction (1889).</p> <p>PRINCE OF WALES' BIRTHDAY.—Classes close.</p> <p>Third Term ends.</p> <p>Annual Examinations begin.</p>	1	W	<p>Technological Museum, Domain, first opened to the Public, 1883.</p> <p>CHRISTMAS DAY. BOXING DAY.</p>
2	Tu		2	Th	
3	W		3	F	
4	Th		4	S	
5	F		5	S	
6	S		6	M	
7	S		7	Tu	
8	M		8	W	
9	Tu		9	Th	
10	W		10	F	
11	Th		11	S	
12	F		12	S	
13	S		13	M	
14	S		14	Tu	
15	M		15	W	
16	Tu		16	Th	
17	W		17	F	
18	Th		18	S	
19	F		19	S	
20	S		20	M	
21	S		21	Tu	
22	M		22	W	
23	Tu		23	Th	
24	W		24	F	
25	Th		25	S	
26	F		26	S	
27	S		27	M	
28	S		28	Tu	
29	M		29	W	
30	Tu		30	Th	
			31	F	

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SYLLABUS
OF THE
DEPARTMENT OF AGRICULTURE.

HENRY LORD, G.T.C.A.C., Lecturer (in charge of Department).

THE leading purposes of the Agricultural Department of the Technical College are to supply—First, the knowledge needful to ensure successful occupation of the land for the very large numbers of both sexes who are desirous of changing town for country life ; and secondly, to supply technical scientific experience to those engaged in various branches of agriculture, and who have time for lessons only in their spare hours. The subjects, as taught, are grouped, to be as seasonable as possible. The appliances of the College are sufficient for the foregoing, while the cost to students is on a very moderate scale. The instruction given, as the syllabus explains, is comprehensive.

The main divisions of agriculture—live stock, horses, cattle, sheep, dairying, pigs, poultry, and bees ; general crop farming, for the colder and semi-tropical sections of the country ; orcharding, vineyarding and wine-making, fruit-growing, factory processes of fruit-preserving, market and general gardening, flower culture,—and other divisions are included.

Soil examinations and the relations of geology, botany, chemistry, physics, the indigenous timbers, grasses, and herbs to the qualities of Australian soils, and what they are most capable of producing, are attended to very closely ; also drainage, irrigation, mechanics of agriculture, use of tools and implements, &c.

The science of dairying, the nature of chemicals for checking and destroying fungus and insect enemies, &c., the making and compounding and the qualities and uses of manures for making crops come into the course of instruction. In the second session are included chemistry operations so far as they specially pertain to agriculture, soil tests, plant analysis, the chemistry of wine-making, the agencies for producing cold, chilling, freezing, &c., sugar-making, distilling, milk and water tests, compounding of fluids for destroying fungus and insect pests, and other matters of importance in agricultural practice.

Field Lessons.—In order to make the instruction as practical as circumstances permit, the classes go out for field instruction on alternate Saturdays, and when holidays are available, during the entire session. The students are mostly adults, and being prepared in the class-room for the work to be done, and taking, as they do, a personal business interest in it, general knowledge of soils, native vegetation, and other qualifications for land occupation are acquired readily; and students become expert in pruning and other operations of field and garden practice. Poultry and bee-keeping are taught practically. Those desirous of advancing further in theoretical and practical chemistry, geology, the business of wool sorting and classing, veterinary science, farriery, carpentering, blacksmithing, and other branches useful for country residents, are encouraged to join the special classes for those occupations. (See list of subjects for diploma in p. 4.)

The following syllabus gives an outline of the instruction available for first, second, and subsequent courses of instruction. The subjects taught are arranged specially for suburban and country residents.

ELEMENTARY AGRICULTURE.

FIRST YEAR.

(As closely as practicable the instruction throughout the session is seasonable for the farm, garden, and other agricultural work going on at the time.)

Australian Agriculture—Character and Prospects.—Formation and nature of soils of New South Wales; agricultural soils; richness of soils; what the indigenous vegetation tells; mechanical state of soils; the contents.

Climate and Rainfall.—The seasons; suitability of districts for various branches of agriculture; prevailing winds, and their effect on vegetation.

Selecting Land, Clearing, Building, Fencing, &c.—Choosing land for live stock and cultivation; materials available; seasons for operating.

Water Supply.—

Agricultural Draining.—What it means; methods; cost; effect on soils; crops, &c.

Mechanics of Agriculture.—Principles; good tools the cheapest labour, &c.; ploughing; harrowing.

Cultivation of Crops.—The objects in view; means employed; methods of cultivation.

Grain Crops.—Quantities of seed per acre; broadcast and drill sowing; farming maize, wheat, barley, oats, rye; feed, grass, and hay crops, &c.; harvesting and marketing.

Root Crops.—The basis of progressive agriculture; potatoes, turnips, mangolds, beets, sweet potatoes, yams; harvesting, storing root crops.

Making and Using Manures.—How crops are made; what plants get from soil, air, rain, &c.; the Australian compost heap; time for manuring; waste of manures.

Live Stock in Australian Agriculture.—Grazing; farming; cattle, sheep, &c.; relations of soil to live stock; live and dead weight; stock for exporting.

Dairying.—Country and stock available ; requirements for success ; milk, ing ; nature of milk ; cream ; butter and cheese making ; dairy, factory, creamery systems ; modern appliances.

The Pig.—As an Australian product ; paddock and sty systems ; feed and feeding ; the pig that pays ; breeds ; killing, curing, marketing.

Poultry.—Requirements for success ; breeds for egg-laying, table, and export ; breeding, rearing ; hen-mothers, incubators ; ducks, geese, turkeys ; diseases of fowls.

Bee-keeping.—As a business in Australia ; suitable country, and conditions necessary for success.

The Home Garden.—Vegetables, fruits, flowers. Home gardening the best school for agricultural training ; choice and treatment of soils ; cold and warm seasons ; vegetable crops ; manuring, sowing, cultivating, harvesting.

Fruit culture.—Preparing land ; selecting trees ; planting, pruning, cultivating ; budding, grafting, propagating.

Flowers, &c.—Bush and glass-house treatment. Australian, European, American, and Chinese systems of gardening.

Fungus and Insect Pests.—Their nature and treatment.

Seasonable Work for the Whole Year.—Lessons in seasons.

ADVANCED AGRICULTURE.

SECOND YEAR.

Scientific Aspects of Agriculture.—Tests for soils ; how crops are made ; crop food as got from soil, &c. ; life process of plant-growth.

What Indigenous Vegetation tells of the Soil, Climate, Seasons, &c.—Tests for water and ash contents of plants ; acids and alkalis of agriculture.

Australian Experiences in sowing, &c. ; crops for home use ; for feed ; for marketing.

Irrigation, Water Storage, &c.—Relations of plants to water ; methods of applying water ; quantities for different crops ; effect of the seasons ; rain and irrigation ; storing water, &c. ; sewage irrigation.

Live Stock in Australian Agriculture.—Types of cattle in Australia ; dairy stock.

Orcharding.—Draining, planting, pruning, &c.

Sheep and Wool.—Soil and grasses affect quality and weight ; wheat and sheep farming ; small and large flocks ; sheep for wool and for mutton ; crossing for wool and mutton ; marketing wool ; exporting mutton.

The Horse in Australia.—Breeding, rearing, training, feed, &c. ; points for judging.

Advanced Dairying.—Feeds, breeds, milk products, testing milk, cream, butter, cheese, salt, &c. ; use of testing appliances ; factory and creamery systems ; pasteurising, sterilising, preserving, &c.

Value of Feed Materials.—Their making ; siloing ; chemical changes.

Manures.—Their contents and values ; compounding artificial manures ; seasons for manuring ; use and abuse of manures.

Rotations in Cropping.—What crops are available for Australian purposes.

Semi-tropical Farming.—Effects of temperature and rainfall on crops ; sugar ; tobacco, arrowroot, &c.

Crops we might grow.—For rotation and for sale.

Fruit Preserving.—For domestic and commercial purposes.

Grape-vines in Australia.—Wine-making and distilling.

Fungus and Insect Enemies.—More advanced treatment ; seasons when most dangerous ; how to detect, check, or destroy them.

AFTERNOON CLASS.

Held in the College on Mondays, at 4 p.m. The course includes soil examinations ; elementary botany ; qualities and uses of indigenous grasses, shrubs, trees, &c. ; principles of plant-life ; Australian seasons ; rainfall ; seed-sowing ; planting ; pruning ; propagating ; hybridising ; vegetable, fruit, and flower gardening ; fruit preserving ; poultry and bee farming ; silk culture ; dairying for milk, butter, cheese ; tests for water, milk, &c. ; fungus and insect pests, their nature, detection, and treatment, and such other subjects as may be suitable and seasonable.

SPECIAL CLASSES FOR DAIRY SCIENCE, &c.,

Are held in the College on Mondays and Wednesdays. The subjects taught are outlined in the foregoing syllabus, advanced course.

COUNTRY CLASSES—FOR SPECIAL SUBJECTS.

Arrangements may be made, through the Superintendent, Technical College, Sydney, for special courses of instruction, extending over eight or more weeks. Any of the subjects in the foregoing syllabus can be chosen.

Arrangements can also be made for single-lesson lectures on any of the foregoing subjects, by the Lecturer in Agriculture, for Schools of Art, Agricultural Societies, and other public bodies, as opportunity offers.

Text-books :—Mackay's "Australian Agriculture" ; Oliver's "Milk, Butter, and Cheese" ; "Farmers and Fruit-growers' Guide" ; published by Department of Agriculture, N.S.W.

Diploma.—To obtain a diploma in Agriculture, students must attend the full course of instruction and pass the prescribed examinations. In addition, the subjects marked Introductory and any four of those marked Extra must be taken.

Introductory or con-	{	Geology, Economic.
current Subjects...		Botany, Bacteriology.
		Chemistry, Practical.
Principal Subject ...		Agriculture.
	{	Wool Classing.
		Mechanics, Applied.
		Physics. (Course A.)
		Farriery, Practical.
		Blacksmithing.
Extra Subjects ...		Building Construction.
		Carpentry and Joinery.
		Steam and Steam-engine.
		Sanitation. (Course B.)
		House Painting.
		Freehand or Model Drawing.

SYLLABUS

OF THE

VETERINARY SCIENCE CLASS.

LECTURER :

JAS. DOUGLAS STEWART, M.R.C.V.S., &c.

THE lectures delivered and the demonstrations given in Veterinary Science are specially adapted to impart a sound education of practical utility to those interested directly or indirectly in the care and management of live stock.

The first year's course of instruction, which is as comprehensive as is needful, is essential to those who wish to study animal life in health and in disease; for unless a knowledge of the structure and functions of the various organs, glands, and tissues of the animal economy has been acquired, one cannot appreciate the diagnostic symptoms of disease. The lectures are illustrated by diagrams, models, dissections, and microscopic preparations, which are of invaluable assistance to the students.

In the second year's course of lectures great attention is devoted to the best methods of managing live stock, so as to keep them in a healthy condition, for the prevention of ill-health is as important, if not more so, than the cure of disease. Nevertheless, a sound practical education in the practice and principles of veterinary medicine and surgery is also included in the curriculum. As the horse is the chief of those animals subservient to man, this animal receives most attention; still the ox, sheep, pig, and dog are also well considered.

The students receive practical demonstrations weekly at the Zoological Gardens on the living and also on the dead subject, and by permission of the Board of Health have the privilege of visiting the public abattoirs, by arrangement, to inspect meat, and to become familiar with the lesions of those diseases which render the carcasses of the ox, sheep, and pig unfit for human food. Occasionally the students are invited to the lecturer's veterinary hospital to witness interesting operations, &c.

The complete course of instruction in Veterinary Science extends over three years.

For certificates in Veterinary Science the student must attend the lectures and demonstrations, and pass the prescribed examinations.

The students can, if they so wish, take the course of the first and second years conjointly.

Lectures, demonstrations, and general instructions will be given during each term on the following subjects:—Anatomy (theoretical and practical), physiology, veterinary (medicine and surgery), with practical demonstration.

FIRST YEAR.

ANATOMY.

Lectures on Anatomy are divided into :—

I.—Elementary Anatomy.

(a) *Osteology*.—A general description of all the bones of the Horse will be given, and the bones of the Ox, Sheep, Pig, and Dog compared with them.

(b) *Arthrology*.—The various joints with their ligaments are described.

II.—Advanced Anatomy.

Includes a description of the following—

Alimentary Tract.—The mouth, tongue, pharynx, gullet, stomach, intestines, liver, spleen, pancreas, &c.

Respiratory Tract.—Nostrils, larynx, trachea, lungs, diaphragm, &c.

Vascular Systems.—Heart, blood-vessels, and lymphatics.

Nervous Systems.—Brain, spinal cord, and principal nerves.

Renal and Generative Systems.

The foot of the Horse.

III.—Special Comparative Anatomy.

The leading features and peculiarities in the above organs and structures as found in the domesticated animals other than the Horse.

Text-books :—Strangeway's "Veterinary Anatomy" or M'Fadyean's "Anatomy of the Horse"; and Fleming's "Atlas of the Horse."

PHYSIOLOGY.

Introduction.—Physiology; its nature and objects. The distinctions between living and lifeless matter are discussed; after which the general functions of plants and animals are explained. Veterinary physiology; the blood; the heart and blood-vessels; circulation; vascular glands; respiration; chemistry of food; digestion, stomach and intestinal; the liver and pancreas; absorption; the skin; urine; animal heat; nutrition; muscular action and locomotion; nervous system; the foot; generation and development; growth, decay and death.

Text-book :—Furneaux's "Animal Physiology."

SECOND YEAR.

Stabling.—Construction, ventilation, and management of stables; grooming; operations of decoration; management of feet; restraints; accidents common to the stable; stable habits and vices, and their treatment.

Food and Feeding.—The various kinds of food; their composition and nutritive value; cleanliness and mixture of foods; preparation of food—dry and moist; principles of feeding; errors in feeding and the result; founder, staggers, tympanitis, colic, &c.

Water.—Thirst; kinds of water; temperature of water; quantity and modes of watering; effects of errors in watering.

Text-books :—Fitzwygram, on "The Horses and Stables"; Steele, "On the Ox" and "On Sheep"; Hill, "On the Dog."

THE HORSE.—*The points of the horse*; the various breeds of horses, and their characteristic points.

Breeding.—Hints in foaling; aids to parturition and rearing.

Purchase of Horses.—Hints in; tricks of dealers; action.

Soundness and Unsoundness.—Definitions; methods of conducting an examination; seat and causes of unsoundness—special attention being paid as in the eyes, nostrils, teeth, legs, &c.

Lameness.—Causes; seat and treatment.

Diseases.—Causes; symptoms and treatment of diseases of the digestive, respiratory, and renal tracks; nervous diseases—stringhalt, chorea, shivering, &c.

Surgery.—Principles of Surgery; benefits of antiseptic treatment; description of the following pathological conditions: inflammation, suppuration, abscess formation, ulceration and gangrene.

Injuries and Wounds.—Incised, punctured, lacerated, contused, fistulous; cysts; Hæmorrhage; sprains.

Injuries to and diseases of bone, Dislocations.

Operations.—Castration, excision of tumours and cancerous growths, extraction of teeth, &c.

CATTLE.—Introduction; the critical points in cattle, and the characteristic features of the various breeds; hints in breeding, and the influence of heredity; the care and management of dairy herds.

Diseases.—The history, symptoms, treatment, and pathology of the chief bovine scourges:—Tuberculosis, pleuro-pneumonia, anthrax, actinomycosis, tick, &c. Diseases peculiar to dairy herds—milk-fever, and other troubles connected with parturition; hoven, and udder affections; abortion.

SHEEP.—Hints in the selection of rams and ewes for stud purposes; lambing and its troubles.

Diseases.—History, symptoms, treatment, and pathology of anthrax or Cumberland disease; black-leg; fluke; footrot; hydatid; lung and intestinal worms; scab, &c.

SWINE.—General consideration of the habits; the feeding, breeding, and rearing of pigs.

Dog.—The symptoms and treatment of prevalent maladies.

PRACTICAL CLASS.

FOR FIRST AND SECOND YEAR STUDENTS.

Meeting on each Wednesday, at the Zoological Gardens, Public Abattoirs, or elsewhere (by arrangement), at 2:45 p.m.

(a) *The conduction of Post-mortem Examinations and demonstrations in Anatomy.*

(b) *The inspection of Meat.*

(c) *Demonstrations on the Horse:—*

1. His points, marks, height, breed, colour, age, and adaptability.
2. Methods of approaching and handling of animals; picking up feet; clothing; bandaging; harnessing, &c.
3. Methods of approaching and examining sick animals.
4. Methods and contrivances used in casting and securing animals for operations.
5. Methods of administering medicines by mouth,—ball and drench; by inhalation; and by injection.
6. Vices in horses—their prevention and cure.

(d) *Lameness.*—Its location by sight and by manipulation.

SYLLABUS

OF THE

FARRIERY CLASS.

LECTURER:

JAS. DOUGLAS STEWART, M.R.C.V.S., &c.

THE course of instruction in farriery is specially adapted to impart to improvers and apprentices a thorough and practical insight of their work, and thus supply a long felt want to the trade.

The horse's foot is looked upon by the average individual as a block of inert matter at the extremities of the limbs, instead of which it is one of the most highly organized and specialized structures known to anatomists.

Many horses are rendered cripples and their usefulness prematurely ended through ignorance of the structure and functions of the vital parts of their feet. This class offers to all farriers a ready access to acquire this knowledge; and it is hoped that a "Certificate in Farriery" will become as essential to the farrier as a diploma is to the veterinary surgeon.

To gain a certificate in farriery the student is required to pass both the theoretical and the practical examinations.

This course is illustrated by preparations, models, casts, drawings, and anatomical specimens.

(A).—THE HISTORY OF FARRIERY.

(B).—ANATOMY OF THE FOOT:—

(1). The sensitive foot—The bony column and joints with their ligaments, tendons, foot pad, cartilages, laminae, wall, sole and frog, coronary substance—Blood-vessels, nerves, and lymphatics.

(2). The insensitive foot—The horny wall, sole and frog. Their growth and development.

(C).—THE PHYSIOLOGY OF THE FOOT:—

Circulation (arterial and venous); nerve supply; growth and wear of horn; description of the mechanism (expansion) of the foot; the fore-limbs as weight-bearers; the hind-limbs as propellers; anomalies of size, shape, and position of feet.

(D).—PRINCIPLES OF SHOEING:—

Management of horse's feet.

General description of the healthy foot in relation to shoeing; varieties in shape, size, and direction of feet, which render modification in shoeing necessary; description of the various shoes and their use, such as the fullered shoe, stamped, seated, concaved, concavo-convexed, bar, calked, racing and trotting plates, &c., &c.

(E).—SURGICAL SHOEING :—

Methods of examining the feet for the detection of the various diseases ; description of the conditions known as fissure, sandcrack, seedy toe, corn, dropped sole, thrush, canker, pyramiditis, side bones and ring-bone, and the best methods of shoeing horses suffering from any of the above abnormal conditions.

Devices used in modifying defective action, such as brushing, knocking, speedy cutting, over-reaching, &c.

(F).—PRACTICAL SHOEING :—

Removal of shoes and the dressing of feet. Method of measuring the feet. Use of the various tools of trade ; the selection of nails. The moulding and forging of shoes. Fitting and driving in all its branches.

SYLLABUS

OF THE

DEPARTMENT OF TRAINING IN SHEEP AND WOOL.

ALFRED HAWKESWORTH, Lecturer (in charge of Department).

Day and Evening Classes.

WILLIAM HAYES, Assistant.

To obtain the Diploma in this Department the student must have the certificates and must also have done at least two years' satisfactory practical work. The certificates required are :—

Sheep Judging.
Wool Sorting.
Wool Classing.

Wool Scouring.
Fellmongering.
Veterinary Science.

The instruction in this Department is imparted in the day classes by the following methods :—

1. Practical Class Teaching.
2. Practical Demonstration.
3. Visits to Saleyards, Shows, &c.
4. Popular Lectures.

The course of instruction embraces the following subjects :—

- (a) The Sheep.
- (b) Sheep Classing.
- (c) Sheep Judging.
- (d) Wool Sorting.
- (e) Wool Classing.
- (f) Preparing Wool for the Market.
- (g) Valuation of Wool.
- (h) Uses of Wool.
- (i) Wool Scouring.
- (j) Fellmongering Wool.
- (k) Shearing-shed Work.

Text-book :—A. Hawkesworth's "Sheep and Wool."

MODE OF TRAINING.

The mode of training is of the most useful and practical kind, and is framed to fit each student to undertake the classification, skirting, rolling of fleeces, and sorting the skirts or pieces to the best advantage of the grower, and also to meet the demands of the buyers. As the practical work advances, lectures upon all subjects relating to the growing of wool and its suitability for manufacturing purposes will be given. The Sydney wool sales afford all facilities for gaining information of the general routine of the business, special attention being given to valuating.

TRAINING TERM.

The period of instruction begins in the first week in February, and terminates on the 31st of July of each year, at the time of the Sydney sheep show and stud sheep sales. These two events afford valuable opportunities for study, and serve as finishing lessons to those students who intend adopting station life as a profession. Practical instruction is given in the morning and afternoon. Friday afternoons are devoted to lectures. During the term visits are made also to convenient stations, for sheep classing and other purposes.

STUDENTS ON STATIONS.

After the term expires capable students, who have been industrious and are desirous of going on to stations to gain shed experience, will be recommended to squatters to skirt-roll fleeces and sort pieces at current wages.

PURCHASING OF WOOL.

Unskirted and unclassed wools will be purchased from time to time. These varieties of wool furnish exactly the requirements for classing and sorting besides being a means of giving students intended for station life a thorough knowledge of skirting, rolling, and making up the fleeces in the best marketable styles.

WOOL CLASSING FOR THE TRADE.

Arrangements will be made with smaller wool-growers (through their agents), whose lots of wool are too small for station classing, to send such lots to the College for classification. The requests received by agents from this class of wool-growers for the classing of their wool are very numerous, but up to the present the wool department of the Technological Museum has been unable to afford assistance on any large scale to the agents. Much good could be done in this matter, and a moderate scale of fees will be charged, as is done by other departments in the assay of ores, analysis of plants, soils, &c. All wools classed under this arrangement will bear the College stamp.

SHEEP CLASSING.

Some difficulty presents itself in arranging for this section, as the sheep are not so easily obtained and handled as wool, but to a great extent the difficulty will be overcome. In the first place, during the time a student is learning the wool trade, he is obtaining the knowledge necessary for sheep classing, and sheep classing cannot be done except by one possessing a good knowledge of wool. It is intended to make arrangements for taking the students to visit, at the proper season, conveniently-situated stations where sheep classing is done. Applications will also be made for the purpose of allowing students to examine sheep at country shows, under the superintendence of the Lecturer. If practicable, also, the Homebush Saleyards will be utilised for similar instruction. Such visits would tend to prepare the students for the more advanced branch of sheep judging.

LECTURES AND DISCUSSIONS ON SHEEP AND WOOL.

Lectures will be given upon sheep and wool at the country shows, and as many of the shows take place after July, a great deal of good should be done to our staple industry. It is a well known fact that the greater part of the colonial wools are placed upon the market in a very indifferent manner, and if subjects relating to wool could be discussed at these shows, it would be of great benefit to the grower and the public generally. There are about 44,000,000 of sheep in New South Wales, and it is considered by the highest authorities that if information such as proposed in these lectures were given, a general improvement in the flocks would result, and as it is computed that every sheep would produce 1s. worth more wool, the total annual gain to the Colony would be £2,200,000.

SYLLABUS.

Skirting Fleeces.—By unrolling fleeces on the tables, taking all inferior, seedy, and dirty edges off.

Rolling Fleeces for Sale.—After skirting, each fleece to be properly rolled and fastened so as to show it to advantage, and to best suit the demands of buyers.

Sorting Skirtings.—Skirtings to be sorted into classes required by the trade, so as to realise the highest prices.

Classing Fleeces.—Classing fleeces into two or three grades of combings and clothings, as required by the trade.

Sorting or Dividing Fleeces.—Sorting fleeces by dividing each fleece into as many distinct sorts as it contains, necessary for the demands of the manufacturer.

Valuation of Wool.—Valuation of wool will be taught in connection with wool sorting, and regular visits will be paid to the wool sales, when each lot for sale can be inspected, and the value put down on the catalogue, and the resulting price compared as the lots are sold. The valuations will occupy the mornings and the sales the afternoons of same days.

Fellmongering.—As much instruction as possible to be given at the College. Arrangements to be made for visiting large works under the superintendence of the Lecturer.

Wool Scouring.—Practical lessons are given at the College, where a complete plant has been erected for the purpose. Arrangements are made for visiting large works, under the superintendence of the Lecturer.

Sheep Classing.—Sheep-classing instruction to be given as far as possible in the College by means of complete models of different types of sheep, and by frequent visits made to Homebush and country shows, under the superintendence of the Lecturer.

Sheep Judging.—Sheep judging will be taught at the College and at shows. The present Sheep and Wool Training Department has frequent applications from country shows for sheep judges. Students will be afforded every facility to accompany the nominee.

Shearing-shed Work.—All wools will be handled as in a shed during shearing time.

WOOL SORTING (EVENING CLASS).

ONE YEAR COURSE.

SYLLABUS.

- | | |
|---------------------------|----------------------------------|
| 1. Picking up fleeces. | 5. Classing cross-bred wools. |
| 2. Skirting fleeces. | 6. Sorting pieces. |
| 3. Rolling fleeces. | 7. Sorting for the manufacturer. |
| 4. Classing Merino wools. | |

WOOL SORTERS' CERTIFICATES.

Regulations Regarding Issue.

Special examinations in this Department will be held in Sydney between the months of March and July (both inclusive), as may be necessary, and of which notice will be given.

Issue of certificates will be confined to those only who have attended the Technical College examinations.

No person can obtain a "Full" certificate who has not passed the Technical College examination.

Certificates will be issued by the Department of Public Instruction on recommendation of the Board.

The certificates issued shall be of two kinds—"Full" and "Provisional."

"Provisional" certificates may be granted to Technical College students or candidates who may pass a satisfactory examination, but who have not had sufficient practical wool-classing experience.

The "Provisional" certificate will be exchanged for a "Full" certificate when the holder has done at least two years' satisfactory practical work.

Technical College students applying for exchange of "Provisional" for "Full" certificate must forward 10s. with such application, which amount will be refunded in full should certificate not be granted.

Persons who require certificates, but who have not attended the Technical College classes, may, on giving two weeks' notice and forwarding fee of 21s., present themselves at the annual examinations. In the event of their being unsuccessful half the amount will be refunded.

In the event of any misdemeanour or complaint against any wool-classer's conduct, the Board reserve the right on inquiry to suspend or cancel such person's certificate.

SYLLABUS

OF THE

DEPARTMENT OF CHEMISTRY AND METALLURGY.

W. A. DIXON, F.I.C., F.C.S.—Lecturer (in charge of Department).

G. A. BYRN, Demonstrator.

THE chemical laboratory, which stands in the middle of the College yard, is a rectangular building, quite plain, and without any architectural adornment, and has about 4,000 square feet of floor, with a covered yard at each end. One of these accommodates a gas engine and Root's blower, also grinding and powdering appliances, and in it such operations as cause noise or dust or give rise to acid fumes are conducted.

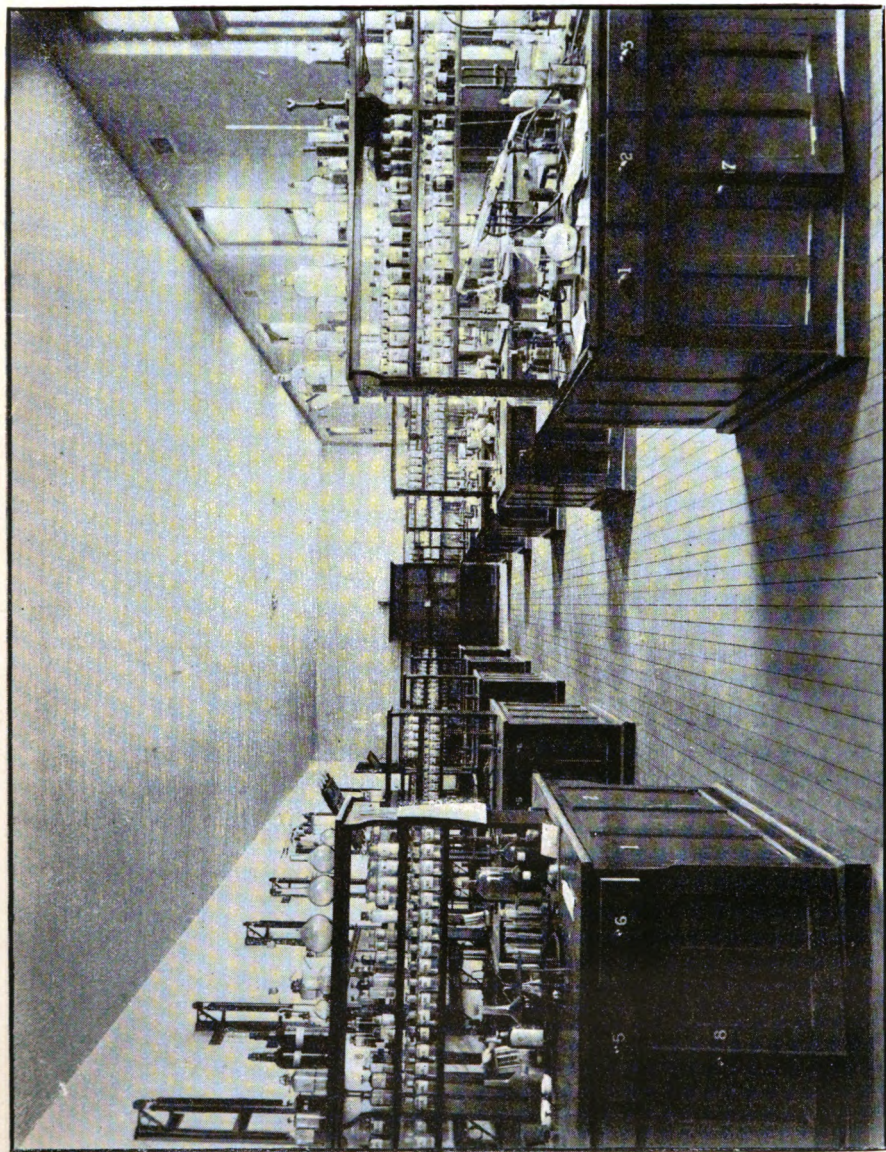
The main laboratory, which occupies half the building, has accommodation for 38 students at once, or 114 at different times, each student being provided with a working bench, a drawer, and cupboard, with locks and keys, for his apparatus. Each bench is fitted with water and gas, and the student has opposite him all the reagents he requires; he need not, therefore, leave his bench, except to evolve sulphuretted hydrogen gas in the vapour closets at each end of the laboratory.

The assay furnaces are at one end of the same room—there are four melting fires and a muffle worked with coke, and three melting fires and a muffle worked with gas and an air-blast. There are also a complement of Fletcher's gas furnaces worked by a draught, which can be used in No. 2 yard. Abundant facilities are, therefore, at hand for learning metallurgic work, both as applicable in the bush and in towns.

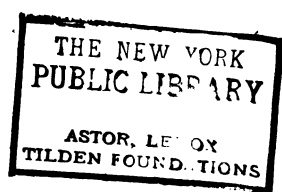
The lecture room has accommodation for 100 students, and it has cedar cupboards and cases on two sides, containing apparatus for lectures and chemical and metallurgic specimens. At the back of the lecture table there are a couple of sets of rollers mounted with diagrams finely drawn on tracing cloth to illustrate chemical apparatus used in manufacturing operations.

There is a store-room for chemicals, in which the reagents required in the laboratory and lecture room are made up, and next to this is the instrument room, containing chemical and assay balances, spectroscopes, standard barometer, hydrometers, &c. The lecturer's private room is temporarily arranged so that it can be used for polarimetric and similar work requiring the exclusion of daylight.

The laboratory is sufficiently furnished with apparatus, and Mr. Dixon has a quantity of separate apparatus for special work, so that complete instruction can be imparted in every branch of chemistry bearing on arts, industries, or manufactures, and aid given in original research. It has been borne in mind, however, in designing and furnishing the laboratory, that the student should learn to improvise apparatus with materials at hand, that is, to use his brains rather than rely on the instrument maker, as he would then be less likely to be left stranded if away in the bush far from a well-equipped laboratory. It may be noted in this connection that some of the most important chemical discoveries have been made with such improvised apparatus.



CHEMISTRY DEPARTMENT--LABORATORY.



For the Diplomas in Chemistry and Metallurgy, students must attend the following classes:—

(a) *Chemistry—Elementary, 1st year Course.*

Introductory or concurrent Subjects	{ Mathematics	1st year.
	{ Physics	A, B, and C courses.
Principal Subjects ..	{ Practical Chemistry including Qualitative analysis.	2 years evening or equivalent in day work.
	{ Theoretical and Descriptive Chemistry	2 years.
	{ Quantitative analysis ..	2 years day.
Extra Subjects	{ Model or Freehand Drawing	1st year.
	{ Architectural Drawing	1st year.

(b) *Metallurgy.*

Introductory or concurrent Subjects	{ Physics	A, B, and C courses.
	{ Mathematics	1st year.
Principal Subjects ..	{ Theoretical and Descriptive Chemistry	2 years.
	{ Practical Chemistry (Qualitative analysis) ...	2 years evening or equivalent in day.
	{ Quantitative analysis and Assaying	2 years (day).
Extra Subjects	{ Mineralogy.....	{ 1st year.
	{ Freehand or Model Drawing	
	{ Mechanical Drawing	

THEORETICAL AND DESCRIPTIVE CHEMISTRY.

CHEMISTRY OF THE NON-METALLIC ELEMENTS.

FIRST YEAR LECTURES.

This class is principally conducted tutorially—the text-book being explained and illustrated by experiments when necessary. It is necessary that students join at the beginning of the session.

SYLLABUS.

Introduction.—Indestructibility of matter ; general idea of chemical combination or decomposition in definite proportions ; the three states of matter ; chemical nomenclature ; outline of the properties of the fifteen principal non-metallic elements.

Hydrogen.—Its occurrence and preparation ; the general properties of matter in the gaseous state ; diffusion ; gaseous pressure ; osmose ; effusion and transpiration of gases.

Chlorine.—Reactions for obtaining ; manufacture on a large scale ; combination of gases by volume and weight ; hydrochloric acid—composition, making, and manufacture ; uses of chlorine, bleaching, &c.

Bromine and Iodine.—Occurrence, preparation, and uses ; compounds with hydrogen and chlorine.

Fluorine.—Occurrence ; hydrofluoric acid ; preparation, uses, etching glass, &c.

Oxygen.—A diad element, therefore different from monads already considered ; preparation from various sources, and industrially from the atmosphere by various processes ; uses, to produce high temperatures by chemical reaction ; ozone, and preparation of same ; allotropic modifications ; combinations with hydrogen ; volume condensation ; water ; properties of matter in the liquid form ; molecular movements shown in diffusion and osmosis ; expansion by heat and cold ; water in the solid form ; the laws governing the relations of heat to the three states of matter, and the

importance of these laws in nature ; absorption of gases in water and liquids, and the laws governing the same. Hydrogen dioxide ; combinations of oxygen with chlorine, bromine, and iodine.

Sulphur, occurrence and extraction ; refining into merchantable forms ; allotropic forms in solid, liquid, and gaseous states ; combination with hydrogen, occurrence, preparation, and uses ; combination with chlorine, preparation, and uses ; combination with oxygen, SO_2 and SO_3 ; acid oxides ; preparation of sulphurous acid and sulphuric acid on small and large scale ; their properties and uses ; bleaching by sulphurous acid, &c. ; the other oxygen acids of sulphur.

Selenium and Tellurium ; description ; similarity chemically to sulphur.

Nitrogen.—Preparation from atmosphere and compounds and general properties ; combination with hydrogen ; ammonia ; preparation, uses, combination of nitrogen with chlorine, bromine, and iodine ; substances in unstable molecular equilibrium ; explosives ; oxygen, compounds of nitrogen and acids formed from them ; their formation, manufacture, and uses ; importance to plant and animal life.

Phosphorus.—Occurrence ; preparation ; manufacture ; allotropic modifications ; uses ; match manufacture ; importance to vegetables and animals ; phosphine and other compounds with hydrogen ; oxygen compounds, and acids from same ; basicity of acids producing various modes of combination.

Boron.—Occurrence and preparation ; oxygen compounds ; boric acid ; uses.

Silicon.—Preparation ; compounds ; oxygen compounds ; silica in various forms ; fluorine compounds ; siliceous minerals generally.

Carbon.—Occurrence and various modifications ; manufacture of charcoal, coke, &c. ; combinations with hydrogen ; gas manufacture ; oils—manufacture and extraction ; combinations with chlorine ; with oxygen ; production of heat ; use of carbon and its compounds for fuel.

METALLURGY OR CHEMISTRY OF THE METALS.

SECOND YEAR LECTURES.

This course begins with an outline of the Atomic theory, and the reasons, which can be deduced from the compounds formed as described in the first year's work, and their reactions, for assigning a definite constitution to matter in any form. Crystalline form ; atomic and specific heat, and chemical affinity is then taken up, and the differences produced by pressure ; heat, &c., explained.

The physical properties of the metals are then taken as gravity, lustre, opacity, malleability, and ductility ; the chemical relation of metals to one another in alloys, &c., and to the non-metallic elements and their compounds, which give the means by which metals can be separated from their non-metallic compounds and one another.

The influence of minute traces of "impurities" is referred to as carbon, sulphur, silicon, or phosphorous in iron ; bismuth in copper ; antimony in lead, &c. The metals are then treated as follows :—

GROUP OF ALKALI METALS.—Their occurrence and metallurgy ; properties ; principal compounds their preparation and uses.

ALKALINE EARTH—GROUP OF METALS.—Compounds ; uses ; formation of slags, glass, &c.

MAGNESIUM ZINC GROUP.—

Metallurgy of Magnesium.—Compounds and uses.

Ores of Zinc.—Belgian and Silesian methods of extraction; alloys; rolling; manufacture of zinc plate; compounds of zinc; their preparation and uses; zinc white, Rinman's green, &c.

LEAD GROUP.—Lead and thallium.

Metallurgy of Lead.—Ores; Flintshire, Cornish, and Scotch processes; the water jacket and Spanish furnace; softening of hard lead; condensation of fume; desilverisation of lead; Pattison and Parkes' processes; cupellation; alloys; varieties of lead in commerce; combination of lead with oxygen; litharge, red lead, &c., their formation and uses; other uses of lead salts, and their production for paints, colours, and dyes.

COPPER, MERCURY, SILVER GROUP.—

Metallurgy of Copper.—Ores, smelting; Welsh process; Freiberg process; smelting in blast furnaces; Mansfield process; desilverisation of copper; refining; wet methods of copper extraction; impurities and their effects; alloys; phosphor and silicon bronze; electro-deposition and purification of copper; compounds of copper with non-metallic elements, their preparation and uses.

Metallurgy of Mercury.—Ores of mercury; methods of extraction; Almaden, Idrian, furnace processes; modes of purifying; amalgams; compounds of mercury; their preparation and uses.

Metallurgy of Silver.—Ores; Patio, Cazo, or Calderon and Freiberg processes of amalgamation; cupellation; wet methods of extraction; Augustin's, Ziervogel's, and Von. Pateras' methods; fusion processes; pyrites fusion; physical and chemical properties; alloys of silver; electroplating; compounds of silver, their preparation, and uses; action of light on some of them.

YTTRIUM GROUP.—Scandium, yttrium, lanthanum, cerium, didymium, samarium, terbium, decipium, erbium, ytterbium. These are passed over.

ALUMINIUM GROUP.—Aluminium indium, gallium. Aluminium occurrence and metallurgy; alumina, clays, pottery, bricks, and fire-resisting materials; compounds of alumina; alums; dyeing, mordants, calico printing, &c.

IRON GROUP.—Manganese, iron, cobalt, nickel.

Manganese Ores.—Metallurgy; speigeleisen; ferromanganese; compounds—uses of, in the arts in dyeing, oxidising, &c.; their formation and composition.

Iron.—Ores of; metallurgy of; ancient processes of producing iron and steel direct from ores; modern processes; blast furnaces, hot and cold; charcoal, coke, and coal; qualities of pig produced; general theory of blast furnaces; composition and uses of cast iron; conversion into wrought iron; refining pig; bulldog slag; puddling; pig boiling; Bessimer convertor; Gilchrist Thomas' process; tool steel; cementation melting; furnaces and fuel; Siemen's process; qualities of metal depending on carbon, sulphur, phosphorous, chromium, tungsten, &c.; rolled plates for tin plates and galvanized iron; hardening of steel; iron, compounds of, their manufacture and use in medicine, agriculture, and the arts.

Cobalt.—Ores, metallurgy of; oxide of cobalt; smalt; cobalt blue, green; cobalt combinations, their production and use.

Nickel.—Ores, metallurgy of; production of metallic nickel by smelting operations and reduction; by the use of carbon monoxide; properties of metal and alloys; compounds of nickel.

CHROMIUM GROUP.—Chromium, molybdenum, tungsten, uranium.

Chrome.—Ores; occurrence and properties; conversion of into chromates; colours produced from; sesqui-oxide as colour, as grinding material; chromates as oxidizing agents.

Molybdenum.—Occurrence and uses.

Tungsten.—Occurrence and uses; hardening steel; fire-proofing.

Uranium.—Colouring for glass, &c.

TIN GROUP.—Tin, titanium, zirconium, thorium.

Metallurgy of Tin.—Ores; "stream," "mine," and "wood" tin; separation; smelting of tin ores; chemical reactions involved; refining tin; refined tin, grain tin, block tin; manufacture of tin plate; foreign metals in tin; non-metallic compounds of tin—their use in dyeing and calico printing, preparation, &c.

Zirconium and Thorium.—Occurrence; uses of compounds to produce incandescence.

ANTIMONY GROUP.—Vanadium, arsenic, antimony, bismuth, tantalum, niobium.

Vanadium.—Occurrence; presence in Hawkesbury sandstone shales; compounds used in dyeing, &c.

Arsenic.—Ores; mostly a bye product; production of metal; use in alloys, shot, &c.; compounds of; manufacture of colours, sheep dip, poison, &c.

Metallurgy of Antimony.—Ores of antimony; method of extraction; liquation process; reduction by iron; English process; French method; alloys of antimony; type-metal; hardening effect of antimony on alloys.

Compounds of Antimony.—Uses in medicine, glass-making, &c.

Bismuth.—Ores of New South Wales and Queensland; metallurgy of; use in alloys, fusible metal, compounds of; uses in medicine, &c.

PLATINIUM GROUP.—Gold, platinum, palladium, rhodium, iridium, ruthenium, osmium.

Metallurgy of Gold.—Ores, extraction; extraction by wet methods; chlorination; cyanide process.

Refining.—1. By quartation and nitric acid. 2. By quartation and sulphuric acid. English process; American process; Chinese process by sulphur; Miller's process, casting, rolling, drawing, coining; qualities of gold; meaning of carats fine.

Platinum.—Occurrence, metallurgy and treatment of; uses.

Text-books: Watt's "Inorganic Chemistry"; W. A. Dixon's "Tables for Qualitative Analysis."

CHEMICAL LABORATORY.

EVENING CLASSES IN PRACTICAL CHEMISTRY.

SYLLABUS.

The first year's work embraces the qualitative analysis of simple salts. In the first term the student examines for himself the effects of reagents on known metals; in the second he tests qualitatively for metals; in the third for the components of simple salts.

In the second year the student carries his work on to the qualitative analysis of mixtures of substances of increasing complexity.

CHEMICAL AND METALLURGIC LABORATORY FOR DAY STUDENTS.

All quantitative work must be done during the day, and students must attend at least three full days per week.

Students entering for the Diploma in Chemistry or Metallurgy may do the first and second year's practical work during the day instead of in the evening.

QUANTITATIVE WORK.

For both Chemical and Metallurgic students the first part is the same, viz. :

1. Quantitative determination of the constituents of chemical compounds—*as* sulphate of copper, sulphate of iron, chloride of silver, &c.
2. Separation and quantitative determination of substances, beginning with those whose separation is easy, and passing gradually to those which are more difficult.
3. Organic analysis, *i.e.*, determination of carbon, hydrogen, nitrogen, sulphur, &c., in organic combination, and photometric determinations and gas analysis.
4. Determination of specific gravity and other physical properties of matter.
5. Making quantitative preparations of a few chemical compounds.

Chemical students may then take either—

- (a) Food substances—The examination of water, wines, beers, spirits, milk, tea, coffee, bread, &c., &c., for impurities and adulterations; or,
- (b) Manufacturing substances—In connection with tanning, sugar-making, brewing, gas-making, oil works, dyeing, or other industries.

Metallurgic students undertake calorimetric valuation of fuel, analysis of water for boiler use, analysis of ores and fluxes—their admixtures for furnace charges, and analysis of slags; practical assaying of ores and alloys, of copper, gold, iron, lead, mercury, tin, and zinc by dry and wet methods.

BY-LAWS FOR CHEMICAL LABORATORY.

Students may attend daily from 9.30 a.m. to 4.30 p.m., except on Saturdays, when the laboratory is closed at 1 p.m., and on public holidays; or for shorter times on days to be arranged. In the evenings, as per time-table.

All students at quantitative work must attend at least three full days per week.

Students are supplied with fuel and gas, the use of a set of reagent bottles, the common reagents, and any of the larger and less commonly used apparatus, as balances, burettes, pipettes, measuring flasks, condensers, &c.; also with a working bench, cupboard, and drawer.

Students are to supply themselves with what they require of beakers, blow-pipes, crucibles, evaporating basins, flasks, funnels, filter-stand, filter and test papers, test glasses, test tubes and stands, small tongs, triangles, glass tubing and rod, watch-glasses, platinum wire, foil and crucibles, towels, chloride of platinum, nitrate of silver, iodine and iodide of potassium (for standard solutions); and if studying metallurgy, all crucibles, scorifiers, cupels, borax glass, and assay lead and silver.

SYLLABUS

OF THE

DEPARTMENT OF PHARMACY.

FRED. WRIGHT, M.P.S. (N.S.W.), Lecturer (in charge of Department).

THE complete course of instruction in Pharmacy occupies three years. For the Diploma students must take the following subjects :—

Principal Subjects	{	Materia Medica.....	{	Third Year.
		Dispensing		
		Pharmaceutical Chemistry		Second Year.
Introductory Subjects ...	{	Pharmacy	{	
		Chemistry (Practical)		First Year.
		Chemistry (Theoretical)		

Evidence must also be submitted as to the students' knowledge of Latin and Botany.

SYLLABUS.

PHARMACEUTICAL CHEMISTRY.

The lectures embrace the processes of the manufacture of chemicals used in medicine according to the British Pharmacopœia, and the testing of them according to the directions laid down therein.

1. Acids, organic and inorganic.
2. Chlorine, bromine, iodine.
3. Carbon, phosphorus, sulphur.
4. Potassium, sodium, lithium, ammonium.
5. Calcium, aluminium, cerium.
6. Iron, manganese, chromium.
7. Zinc, magnesium, cadmium.
8. Arsenic, antimony, bismuth.
9. Copper, mercury, lead, silver, gold.
10. Chemicals used in testing.
11. Organic chemicals used in medicine.
12. Vegetable alkaloids.

VEGETABLE MATERIA MEDICA.

Entire Plants, Roots, Woods, Barks, Leaves, Tops, Flowers, Fruit, Seeds, Capsules, Resins, Oleo-resins, Concrete Oils, Volatile Oils, Balsams.

The Natural Orders.

- | | |
|-------------------------|-----------------|
| Class Exogenæ—Sub-class | Thalamifloræ. |
| | „ Calycifloræ. |
| | „ Corollifloræ. |
| | „ Apetalæ. |
| Class Endogenæ. | |
| „ | Acotyledones. |

ANIMAL MATERIA MEDICA.

Class Mammalia

„ Aves

„ Pisces

Class Insecta

„ Annelida

Examination in this subject includes recognition of fresh and dried specimens, and recognition of plants from plates.

DISPENSING.

Weights and measures of the Pharmacopœia—Weighing and measuring—Reading autograph prescriptions—Abbreviations and contractions in directions—Principles of medicinal combinations—Incompatibility—Solubility—Posology—Mixtures—Emulsions—Draughts—Powders—Pills—Plasters—Liniments—Excipients—Gargles—Ointments—Pessaries—Bougies—Suppositories—Antiseptic dressings.

Candidates for a Dispenser's Certificate are required to pass a practical examination in translating and compounding Autograph Prescriptions, and neatness and quickness of work are taken into consideration.

PHARMACY.

This course consists of lectures, demonstrations, and practical work by students.

Pharmaceutical Processes—

Comminution, solution, crystallization, diffusion, dialysis, evaporation, fusion, calcination, distillation, filtration, precipitation, percolation.

Pharmaceutical Preparations—

Aceta, aquæ, chartæ, confectiones, decocta, emplastra, enemata, essentiæ, extracta, glycerina, infusa, injectiones, linimenta, liquores, lotiones, mellita, misturæ, mucilagines, olea, pilulæ, pulveres, spiritus, succi, suppositoria, syrapi, tincturæ, trochisci, unguenta, vapores, vina.

LIST OF TEXT-BOOKS RECOMMENDED TO STUDENTS.

“The British Pharmacopœia.”

Squire's “Companion to the British Pharmacopœia.”

J. H. Griffiths' “Lessons on Prescriptions and Prescribing,” “Materia Medica and Pharmacy.”

Garrod's “Materia Medica and Therapeutics.”

J. M. Bruce's “Materia Medica and Therapeutics.”

W. Whittle's “Materia Medica and Therapeutics.”

J. Attfield's “Pharmaceutical Chemistry.”

J. A. Sempill's “Aids to Pharmacy,” “Aids to Materia Medica,” parts 1 and 2.

All text-books are the editions in which are embodied the recent additions to the British Pharmacopœia up to 1890.

Students doing practical work must provide their own minor apparatus, such as dishes, test tubes, crucibles, &c.

SYLLABUS

OF THE

DEPARTMENT OF MINERALOGY, GEOLOGY, AND MINING.

REV. J. MILNE CURRAN, F.G.S., Acting Lecturer (in charge of the Department).

THE Department of Mineralogy, Geology, and Mining has, besides a lecture room, a working laboratory and museum for practical work, and appliances for the use of students for original research. The Technological Museum offers special advantages to students in its mineralogical and geological collections and mining and metallurgic models, to which the student has access. Students accompany the teacher for practical geological field-work and mining operations in short excursions.

Lectures and laboratory instruction in all branches of Geology, Mineralogy, and Mining are given especially to provide instruction to those qualifying themselves for the Certificate of Mining Manager, and as an introduction to the course in Mining Engineering at the School of Mines within the University of Sydney. Students qualifying themselves at the Technical College may continue their training in Mining Engineering at the University without matriculating, and also be exempt from subjects in which they have taken certificates at the College examinations.

The ordinary *Mining* course is completed in one year, and embraces general instruction in the principles of Mining, Mineral Prospecting, and Exploration, and the details of Metalliferous Mining, which is made as practicable as possible, and is so far experimental that students are taught to conduct many of the operations necessary in the treatment of ores by concentration, amalgamation, and lixiviation, and also to estimate the value of the different classes of ores of gold, silver, &c., a knowledge of which is so necessary to miners and mining managers.

A small quartz-crushing battery is in operation in the College grounds for the instruction of students in experimental work.

To obtain the Certificate as *Mining Manager*, students must produce evidence that they have had two years' experience in a metalliferous mine besides the course laid down.

The ordinary course in *Mineralogy* takes two years at least.

The course in *Geology* is divided into four sections, and takes two years. First year—Section A—*Physical Geology* and one of the other sections, it being optional to take either Section B—*Economic Geology*, Section C—*Practical Geology*, or Section D—*Historical Geology*. Second year—The two sections not taken by students in the first.

The full course for Diploma in Mineralogy is as follows:—

Introductory or concurrent Subjects.	{ Theoretical Chemistry	Two years' course.
	{ Practical Chemistry	"
	{ Physics (Sound, Light, and Heat)	One year's course.
Principal Subjects...	{ Mineralogy	Two years' course.
	{ Geology	Two sections.

The full course for Diploma in Geology is as follows:—

Introductory or concurrent Subjects.	{ Mineralogy	Two years' course.
	{ Theoretical Chemistry	" "
	{ Practical Chemistry	" "
	{ Physics (Sound, Light, and Heat)	One year's course.
Principal Subject ...	Geology	Two years' course.

The full course for Certificate as Mining Manager is as follows:—

Introductory or concurrent Subjects	{ Geology	Two sections.
	{ Mineralogy	First year's course.
Principal Subject ...	Metalliferous Mining	One year's course.
Extra Subjects	{ Practical Chemistry	First year's course.
	{ Theoretical Chemistry	" "
	{ Applied Mechanics	" "

Arrangement of classes for students taking a full course in Mineralogy, Geology, or Mining:—

FIRST YEAR.

Mineralogy.....	First year's course.
Geology	" "
Theoretical Chemistry.....	" "

SECOND YEAR.

Mineralogy.....	Second year's course.
Physics	First year's course.
Theoretical Chemistry	Second year's course.
Practical Chemistry	First year's course.
Mining	One year's course.
Applied Mechanics	First year's course.

THIRD YEAR.

Geology	Second year's course.
Practical Chemistry	" "

GEOLOGY.

SECTION A.—Physical Geology.

The Earth as a Whole.—Its origin, shape, density, and internal condition.

Volcanic and Earthquake Phenomena.—The cooling of the earth, contraction and crumpling of the earth's surface, elevations and depressions of the land, fractures and faults in rock-masses, movements and focus of earthquakes, effects of released pressure in producing volcanic action, geographical distribution of volcanoes and earthquakes.

Denudation of Rocks.—Action of the atmosphere, rain, snow, frost, ice, running water, lakes, springs, the sea, and animal and vegetable life in producing mechanical and chemical denudation.

Accumulation of Rock-forming Material.—Mechanical, chemical (mineral), and animal and vegetable (organic) deposition.

Rocks.—Formation from mechanical, chemical, and organic deposits, alteration in structure by metamorphic action; mineralogical composition; and classification into sedimentary, metamorphic, granitic, trappean, and volcanic groups.

SECTION B.—*Economic Geology.*

(Applied to Mining, Agriculture, &c.)

The Classification and Distribution of Mineral Deposits.—Their mode of occurrence as lodes, veins, seams, impregnations, and alluvial deposits.

Ore Deposits.—Gold, platinum, silver, lead, tin, copper, iron, antimony, bismuth, mercury, nickel, cobalt, manganese, chromium, &c.

Earthy and Salt Deposits.—Clays, chalk, marls, limestone, marble, natural cements, gypsum, rock-salt, phosphate of lime, alumstone, nitre, &c.

Carbonaceous and Sulphur Deposits.—Peat, coal, kerosene shale, petroleum, graphite, sulphur, &c.

Precious Stones and Gem Deposits.

SECTION C.—*Practical Geology.*

(Applied to Geological Field-work, &c.)

The Stratification of Rock-masses.—Alteration in the position of strata subsequent to their deposition as sediment, their bedding dip, strike, faults, flexures, foliation, contortion, conformity and unconformity.

The Examination of Rocks.—Making rock-sections, value of rock-sections in practical geology, determination of rocks by microscope.

Geological Surveying.—Principles and practice of geological field-work and preparation of geological maps and plans.

SECTION D.—*Historical Geology.*

(Applied to Palæontological work.)

Review of Life.—Animal kingdom, vegetable kingdom, and geographical distribution of life.

Palæontology.—Definition of fossils, forms and processes of fossilization, value of fossils in indicating geological chronology, former conditions of climate, and former changes in the arrangement of the oceans and continents; palæontological sub-divisions of the geological record.

Stratigraphical Geology.—Application of palæontology and the principles of stratigraphy in the determination of the chronological succession of strata, the geological record according to Geikie's "Class-book of Geology," and reference to Australian geological formations, particularly to those of New South Wales.

MINERALOGY.

SYLLABUS.

FIRST YEAR.

Physical Properties of Minerals.—Crystallography, simple forms—Naumann's notation; crystalline aggregates; hardness and streak; tenacity; fracture; cleavage; taste; specific gravity; colour; lustre; diaphaneity; refraction; polarisation; electricity and magnetism; sound; smell; touch.

Chemical Properties of Minerals.—Testing with acids and blowpipe.

Description and Determination of Minerals.—According to F. Rutley's "Elements of Mineralogy."

SECOND YEAR.

Physical Properties of Minerals.—Crystallography; complex forms; practical specific gravity determination by balance and by specific gravity bottle; use of microscope in distinguishing minerals by their refracting and polarising properties.

Descriptive Mineralogy and Determinative Mineralogy.—According to Dana's "Elements of Mineralogy and Lithology."

METALLIFEROUS MINING.

Prospecting for Minerals.—A prospector's outfit; how to use the prospecting dish; and how to search for gold, tin, diamonds, coal, &c.

Computing the Value of an Ore.—Sampling ore; how a sample should be taken from the lode or lead, or from a parcel of stone on the surface, and the value of assays.

General Principles of metalliferous mining, with special reference to methods of Australian mining, including details of boring, shaft-sinking, driving levels, timbering, systems of working minerals, drilling, haulage, winding, pumping, ventilation, and lighting.

Physical and Chemical Properties of gold, silver, mercury, tin, copper, sodium, &c., as applied to mining.

Treatment of the Ore.—Some preliminary considerations before deciding on a method for treating the ore and extracting the metal.

Outlines of methods of treatment of free-milling refractory and other kinds of ores.

Practical battery manipulation and details of the work of batteries and other machines. Losses in gold amalgamation will also be treated of.

Plan-making.—How to prepare a sketch plan, showing approximate position of heaves, lodes, shafts, tunnels, and underground workings, and natural surface features.

Preliminary legal considerations.—Taking up and holding claims, leases, and prospecting areas, legal permits, &c., according to the Mining Act and Regulations of New South Wales.

TEXT-BOOKS, &c.

MINERALOGY.—Jordan's "Crystallography"; Rutley's "Elements of Mineralogy"; and a case of blowpipe appliances. Additional for second year—Dana's "Elements of Mineralogy and Lithology."

GEOLOGY.—Geikie's "Class-book of Geology," 1890 edition; Davis's "Metalliferous and Earthy Minerals and Mining." Additional for second year—Rutley's "Study of Rocks."

MINING.—Davis's "Metalliferous and Earthy Minerals and Mining"; Lock's "Mining Machinery."

SYLLABUS

OF THE

DEPARTMENT OF MECHANICAL ENGINEERING.

OWEN BLACKET, Lecturer (in charge of Department).

MECHANICAL DRAWING.—F. D. Edmonds and S. W. Conyers.

APPLIED MECHANICS—Owen Blacket.

BLACKSMITHING—John Jones.

PATTERN-MAKING—William Phillips.

BOILER-MAKING—Samuel Rodgers.

FITTING AND TURNING—F. Camroux; Assistants, J. Hanley and J. Burness.

IRONFOUNDING—William Taylor.

SLIDE RULE—F. Ernest Stowe.

THIS Department provides instruction—(1) for those who intend to follow the business of an engineer or to enter any of the allied professions—(2) for persons engaged in other occupations to whom a knowledge of the theory and practice of engineering would be useful, and supplements the ordinary professional training by systematic technical instruction.

There are four kinds of persons for whom these classes are intended, viz. :—1st. Youths who intend entering the engineering professions, and who will thus be made useful from the time they start work, or will so improve themselves that they will more quickly rise to positions of importance than they would without the instruction offered; 2nd. Those who, being already engaged in the general and drawing offices of engineering firms, wish to acquire a knowledge of, and practice in, the use of tools, appliances, and methods adopted in works; 3rd. Persons who, being acquainted with one or more branches of engineering desire to become acquainted with any other department, or to get instruction that is not always obtainable in a workshop or factory; and 4th. Persons who, having no trade interest, still desire instruction and practice in the use of tools.

The instruction in this department is given in four divisions:—Lecture and class work; drawing office; testing; and workshops. Access to the principal engineering works in and near Sydney, and to the engine-rooms of the magnificent mail steamers has been liberally granted to the students, and they are accustomed to visit them, from time to time, accompanied by the teachers; they thus see in operation the machinery that has formed the subject of their lectures, and the object lessons thus afforded them have proved of great educational value.

For a diploma in Mechanical Engineering the course is as follows:—

Introductory or con- current Subjects.	{	Physics	Course A.
		Descriptive Geometry	1st year.
		Mathematics (Mensuration)	1 year.
		Freehand Drawing	1 "
Principal Subjects.....	{	Mechanical Engineering Lectures	2 years.
		„ „ Drawing	2 "
Extra Subjects	{	Pattern-making	1 year.
		Fitting and Turning	2 years.
		Blacksmithing.....	1st year.
Subsidiary Subjects ...	{	Chemistry (Theoretical)	2nd year.
		Founding	
		Boiler-making	

MECHANICAL ENGINEERING LECTURES.

FIRST YEAR COURSE.

Hydraulics and Pneumatics.
Materials and Structures.
Mechanism of Machinery.

SECOND YEAR COURSE.

Steam and the Steam-engine.
Steam Boilers.
Prime Movers in General.

The Lecture-room is equipped with models exemplifying motions of various kinds, diagrams, and models of machines.

The lectures on each subject will be fully illustrated wherever needful by diagrams, lantern views, models, and experiments; the principles will be fully explained, the mathematical problems worked out, and every endeavour made to give the instruction a thoroughly practical bearing.

APPLIED MECHANICS.

NOTE.—Students before entering this class are advised to attend the class in Physics, Course A.

SYLLABUS OF LECTURES.

FIRST YEAR COURSE.

FIRST TERM.

Hydraulics and Pneumatics.—“Fluid,” two kinds; fluid friction; conditions of equilibrium of floating bodies; hydraulic press accumulators; hydraulic cranes and lifts; arrangement of hydraulic cylinder for two different powers; pumps suitable for charging accumulators; artesian wells; pressure gauges; common lift and force pumps; fire-engines; air-pump; compressing pump; hydraulic ram; hydraulic motors in general; transmission of power by compressed air; water supply of towns; irrigation; canals, locks, aqueducts, and reservoir; pumping plants for various purposes.

SECOND TERM.

Material and Structures.—Experimental demonstrations by the testing machine of the strength and elasticity of materials used in engineering and building, with special reference to iron, steel, and Australian timber—Ultimate and working strength—Limit of elasticity, and factors of safety—Bending moments, shearing stresses, and moments of resistance, and their application to cast and wrought-iron girders and timber beams—Graphical method of determining stresses in braced structures, such as trussed beams, lattice girders, bowstring girders—Iron roofs—Strength of columns and supports—Retaining walls for reservoirs or embankments—Strength of joints and the different systems of riveting.

THIRD TERM.

Mechanism of Machinery.—Definitions of spur and bevel wheels, belts, bands, guide pulleys, screw surface, worm and wheels, screw-threads—Transmission of power by belting, wire-rope, &c.—Conversion of circular into reciprocating motions, including ratchet wheels, feed motions, escapement, &c.

Teeth of Wheels.—General laws and principles—Method of setting out spur and bevel wheels by various approximations to the true curves—Wheel-cutting and moulding machinery.

Parallel Motions, including Watt's, Scott Russell's, and other parallel motions—Exact straight-line motion.

The copying principle in machinery—Screw-cutting lathe, planing, shaping, slotting, drilling, and boring machinery.

Epicyclic trains and their applications.

Cutting tools for various machines—their shape and strength.

Punching and shearing machines and riveting machinery.

SECOND YEAR COURSE—FIRST TERM.

Steam and the Steam-engine.—Heat as a motive power—The history of the steam-engine—The mechanism and details of steam-engines—Construction and use of indicator—Indicator diagrams—Steam passages—Geometrical constructions relative to designing valves and valve motions—Stresses and proportions of various parts—The compound engine for land and sea—Locomotive engine—Triple expansion—Rotary—Westinghouse and various forms of steam-engines—Testing of engines and boilers.

SECOND TERM.

Steam Boilers.—Various kinds of Boilers—Principle of construction—Heating and evaporating surface—Efficiency, strength, and power—Fuels—Testing.

THIRD TERM.

Prime Movers in General.—Injectors, gas engines, petroleum engines, air engines, water motors, turbines, water wheels, hydraulic rams, air compressors and refrigerating machinery with dry air or ammonia, domestic motors of various kinds, application of prime movers to agricultural and manufacturing purposes.

Text-books recommended—Students attending lectures in Applied Mechanics for the first time should read the following books:—Dr. Ball's "Mechanics" (London science Class-books Series), price, 1s.; Dr. Ball's "Applied Mechanics" (Weale's Series), price, 2s.; Anderson's "Strength of Materials" (Text-books of Science), published by Longman, price, 4s.; Perry's "Practical Mechanics," price, 4s.; Cassell's "Technical Manuals;" W. D. Cruickshank's "Boiler Construction."

More advanced students should read—Professor Goodeve's "Principles of Mechanics," "Elements of Mechanism," Steam and the Steam-engine," price, 6s. each; "Workshop Appliances" (Text-books of Science), published by Longman, price, 4s.; Professor Unwin's "Machine Design," price, 6s.

TESTING ROOM.

In the Testing room students are practically instructed in the strength of materials and the modes of testing structures and machinery, with apparatus for illustrating and verifying the laws of mechanics and hydrostatics, or for experiments on friction, &c.

There are two testing machines—one a four-column vertical single lever, 100 ton strain with patent alternative fulcrum, manufactured by Buckton and Co., of Leeds, fitted with Wicksteed's patent autographic recording apparatus and extensometers, by which readings can be made to one ten-thousandth of an inch.

The strain is supplied by hydraulic pressure, and the machine will admit in tension 3 ft. 6 in. long between clip boxes, or 5 ft. 6 in. long between link pins, in compression 4 ft. long by 16 in. square. Transverse pieces 16 in. wide and 6 ft. long between supports, torsion pieces 2 in. diameter, shearing pieces 2 in. diameter in double shear.

The second machine is by Olsen, of Philadelphia, and is capable of exerting a force of 50,000 lb., power being obtained by screws and levers, and is fitted for tension, compression, and transverse strains.

Besides these machines, there are indicators for use in testing steam and gas engines, friction dynamometers for measuring the brake power of machines and engines, and various smaller instruments for making tests required in engineering practice.

DRAWING OFFICE.

In the Drawing Office a complete training in mechanical drawing, extending to the design of machines from given data is given.

The Mechanical Drawing-room will accommodate 50 students, each having his own table and light. It is suitably furnished with drawing copies, diagrams, and mechanical models, including a valuable collection of models by Schröder, of Darmstadt. There is also a collection of photographs of engineering structures. The students of machine drawing have also the advantage of a specially constructed set of models in section illustrating the principal subjects of the course.

COURSE OF INSTRUCTION IN MECHANICAL DRAWING.

Machine Design.

FIRST YEAR.

The principles of projection; the preparation of working drawings to scale from copies, dimensioned sketches, and simple details of machines; shade lining and conventional colouring and dimensioning drawings; preparation of tracings.

SECOND YEAR.

Sketching and dimensioning details of machines and complete machines; the preparation of general arrangements and finished drawings; shading and colouring drawings; proportioning machine; details from standard designs and models.

The practical constructions for drawing out toothed gearing, screw gearing, and worm gearing.

THIRD YEAR.

Methods of proportioning the various parts of engines and machinery—Designing machinery and engines for special purposes, and the general principles on which machines are designed to fulfil their requirements.

MECHANICAL WORKSHOPS.

Pattern-making.

This class is intended for engineering artisans and draughtsmen who wish to acquire a practical knowledge of the use of wood-working tools, so as to be able to make any kind of pattern in a workmanlike manner. Students in the engineering classes will find the systematic course of practical instruction carried out in this class of great value to them. Apprentices and improvers to pattern makers, who wish to advance in their knowledge of the trade, will have the opportunity of doing more difficult work than they are accustomed to have during their apprenticeship. The workshop is equipped with lathes, band-saw, &c., driven by a 2 H.P. gas engine. Students further have the advantage in the foundry of seeing how the pattern is moulded and cast.

ONE YEAR COURSE.

SYLLABUS.

Principles and practice of pattern-making; principles and practice of moulding; the most suitable timber for pattern-making; effect of shrinkage of timber and contraction of castings; double contraction for iron patterns; setting out of wood for wheels, propellers, &c.; making skeleton frames and sweeps; making core-boxes, and use of cores and drawbacks; various reasons for using green sand, dry sand, or loam mould; the principle of burning on, and use of, chaplets and core-bands; the properties of different cast metals and their treatment; the uses of the various tools used in pattern-making and moulding; working of turning-lathe and saws; the best methods of preserving patterns; making and use of moulding-boxes.

NOTE.—Students before entering this class must either have had a year's course in the Mechanical Drawing Class, or must be able to draw or sketch simple pieces of machinery, to show what is intended.

Fitting and Turning.

The aim is to give the student such training as shall qualify him to deal with engineering work in the best manner, by instruction, both theoretical and practical, so that he will be able to take up any work that may be required in connection with engines. For this reason every student has to show that he is proficient in the use of all engineering hand tools before he is allowed to work the machine tools. Screw-cutting is made a special feature of the advanced work.

The fitting and turning shop is 75 ft. long by 45 ft. wide, with a gallery 12 ft. wide surrounding it. The gallery is fitted with benches and vices, and is used for imparting instruction in the use of the hammer, chisel, file, and scraper. The floor contains the heavy machine tools; these include planing, drilling, shaping, slotting, milling, and boring machines, ordinary and screw-cutting lathes, and a variety of small tools.

FIRST YEAR.

SYLLABUS.

Use of hammer and chipping-work; sharpening chipping-chisels; filing, fitting to gauge, and scraping surfaces; screwing bolts and tapping nuts by hand; drilling by hand and machine; boring with bar and cutter in drilling-machine; use of planing and shaping machines; applications of surface-gauge; use of callipers in fitting work; angle-gauges; working of milling-machine, and wheel-cutting machine.

SECOND YEAR.

SYLLABUS.

Description and use of the slide lathe; sliding boring; surfacing and screw-cutting; velocity in boring and turning; calculating change-wheels for lathes; construction and use of lathe tools; proper angle for grinding; reason of various shapes; brass-finishing; practical working of steam and gas engines.

NOTE.—Students before joining this class are advised to attend the Mechanical Drawing Class for one year.

Blacksmithing and Boiler-making.

The blacksmithing and boiler-making shop is a one-storey building, 75 ft. long and 35 ft. wide, adjoining the fitting and turning workshop, and has ten blacksmiths' fires, air being supplied by a Root's blower driven by a 4 H.P. gas engine, which also drives the punching and shearing machine. There are also a gas hammer, giving a blow of a cwt., used for the heavier forgings, rolls, and drilling machines. Both classes use the same workshop on alternate evenings. The students are taught both the practical way of working the material and the theoretical way how to calculate the stress and strength, and to mark off and cut bars and plates to their proper shape and size.

Blacksmithing.

ONE YEAR COURSE.

SYLLABUS.

How to make blacksmithing tools; the practice of making engine and general forgings; how to get the length of round and conical-shaped hoops; tempering tools, drills, and springs; the building of hollow and plain fires; explaining the principles of heavy forgings, and building of crank and other shafts; explaining the principle of case-hardening, and colouring of forgings; explaining the principle of steam and drop hammer work.

Boiler-making,

ONE YEAR COURSE.

SYLLABUS.

The general construction of boilers, illustrated by templates, model-making, and lectures on proportion; riveted joints, double and single shear; furnace-tubes; steam domes; boilers—Cornish, Lancashire, locomotive, and marine; methods of strengthening and staying; testing; fuel and combustion; evaporation.

NOTE.—Students before entering this class are advised to have a year's course in Mechanical Drawing.

Text-books.—Robert Wilson's "Steam Boilers," 5s.; Nelson Foley's "Boiler-making;" Cruickshank's "Boiler Construction."

Iron Moulding.

The foundry workshop is 75 ft. by 35 ft. It is equipped with an overhead traveller capable of lifting 5 tons; a cupola of 30-in. diameter, of the hinge bottom type and air-belt. The air is supplied by a Root's blower, driven by a 6 H.P. steam-engine. The drying stove is 8 ft. square.

TWO YEARS COURSE.

SYLLABUS.

Principles of Moulding—Sand, and how to select—mixing sand, quantities of ingredients for green, dry, and loam moulding and core making—methods of moulding in green sand, dry sand, loam, stereotype or plate—core making and drying stoves—quality and characteristics of pig-iron or scrap—mixing of scrap and pig-iron—chills and chilled castings—moulding boxes—burning on and joining cast-iron—working furnace and fuels used, construction of furnaces—brass founding and brass furnaces—contraction and expansion of metals—bending and breaking castings by contraction.

SLIDE RULE CLASS.

F. ERNEST STOWE, Teacher.

THE Slide Rule may with advantage be used in any department of practical calculation, the subjoined syllabus including but few of the many subjects to which the student is taught to apply it. To those having a knowledge of the Slide Rule the system of Arithmetic becomes clear and more easily manipulated, and by its use the necessity of elaborate formulæ is dispensed with. All results are obtained mechanically, without the use of figures comprising solutions in multiplication, division, proportion, square and cube roots, and the solution of such formulæ as $\sqrt{\frac{x}{y}}$ instantaneously.

Syllabus.

Numeration; the decimal system; Gunther's "line of numbers," calculators; multiplication; division; ratio; proportion; mensuration of lines, areas, solids; quantities and trade calculations; interest and discount; conversion of money, measures, scales, fractions, &c.; reduction; weights of metals, &c.; capacities; specific gravity, &c.

Mechanics.—Levers; screws; screw-cutting; wheel and axle; train of wheels; pulleys and toothed wheels; horse-power; friction; stress and strain; strength of materials; machine design; hydraulics; electrical formulæ, &c., &c.

The Slide rule used is Routledge's Engineer's Rule, being specially designed for the use of engineers, ironworkers, woodworkers, builders, and quantity surveyors.

SYLLABUS
OF THE
DEPARTMENT OF ELECTRICAL ENGINEERING.

R. OXLADE, Lecturer (in charge of Department).

INTRODUCTORY.

THIS department has been established to provide instruction in the principles and applications of electricity in the various branches of Electrical Engineering.

The course of instruction is suited to the requirements of students who desire to become electricians or electrical engineers. Every effort is made to give instruction thoroughly up to date.

In the practical classes, students are taken through a course which includes the jointing and insulating of wires and cables, wiring; the management of dynamos, construction of primary batteries, gauges of wires and cables, tests for continuity and insulation, measurements of currents and potentials, use of tangent and reflecting galvanometers, use of wheatstone bridge, use of portable testing sets, management of accumulators, arc lamps, and incandescent lamps, etc.

For a diploma in Electrical Engineering, the course is as follows:—

- | | | | | | |
|--------------------------|-----|--------------------------|---------------------------------|-----|------------|
| (1) Introductory or con- | { | Mathematics . | ... | ... | One year. |
| current Subjects. | | Physics, Courses A, B, C | ... | ... | " |
| | | Theoretical Chemistry | ... | ... | " |
| (2) Principal Subject | ... | { | Electrical Engineering Lectures | ... | Two years. |
| | | | " " Laboratory | ... | " |
| (3) Extra Subjects | ... | { | Applied Mechanics | ... | 2nd year. |
| | | | Mechanical Drawing | ... | Two years. |
| | | | Fitting and Turning | ... | " |

The subjects of the lectures will not be invariably taken in the order named.

ELECTRICAL ENGINEERING LECTURES.

FIRST YEAR.

The First Year Lecture Course on Electrical Engineering consists of the subjects set forth below, and of the first two Term Lectures on Magnetism and Electricity (see page 40):—

Resistance of circuits in series; resistance of circuits in parallel; shunts and derived circuits; methods of calculating combined resistances.

Electro-magnetics.—Ampere turns; magneto-motive force; magnetic resistance; the magnetic circuit; magnetising force; magnetic induction; permeability; magnetic flux; types of electro-magnets; calculations of ampere turns and lengths of wire; limit of magnetisation; magnetic resistance of joints; magnetic leakage; ampere's laws; calculation of induced electromotive force.

Measuring Instruments.—The tangent galvanometer; differential galvanometer; reflecting galvanometers; astatic galvanometer; horizontal and vertical forms of galvanometer; detector galvanometer; controlling force and deflecting force; wheatstone bridge; metre bridge; Edelmann bridge; wattmeter; electro-magnetic voltmeters; ampere meters; electro-static voltmeter; portable testing sets; electricity meters.

Accumulators or Storage Batteries.—Plante type; modern forms of Plante plate; Faure type; E. P. S., and other types; storage capacity; rates of charging and discharging; specific gravity of electrolyte; testing and dilution of solution; sizes and weights of cell-plates; efficiency of storage batteries; types and sizes used at central stations and for electric traction; sulphating; buckling; detection of faults; the cell tester; durability of plates.

Dynamo Electric Machinery.—Ohms' law and the magnetic circuit; types of field magnets; field magnet coils; series, shunt and compound; Siemen's shuttle armature; relation of electro-motive force to speed and magnetic field; winding of magnets and armatures; the alternate current dynamo; the continuous current dynamo; commutators and collecting brushes; mechanical features of dynamos and motors; speeds of armatures; armature cores; magnetic leakage; constant current and constant potential dynamos; typical modern machines; types of tram and railway motors; types of low speed machines; types of high speed machines; transformers; practical rules for the management of dynamos; bearings; brushes; foundations; insulation.

Electrical Measurements.—The use of testing; methods of measuring the internal resistance of primary and secondary batteries; measurement of resistance by wheatstone bridge; measurements by metre bridge; simple detector method; substitution method.

Electric Lighting.—Modern incandescent lamps for lighting and other purposes; parallel and other circuit grouping; sizes of conductors; drop of potential in lamp circuits; safety rules; feeders and distributing mains; three-wire system; jointing and insulating wires and cables; underground mains and conduits; types of modern arc lamps; direct current arc lamps; arc lamps in series; arc lamps in parallel; carbons; candle power of lamps; consumption of power; overhead constructions; suspension wires; guard wires; insulators, poles, and crossarms; breaking strains; wind pressure; lightning arresters.

The Applications of Electricity.—The telegraph, the telephone, and microphone; submarine cables; mining signalling; motive power and heating in buildings; transmission of power; electric traction; electro-metallurgy; electric welding; wires and cables.

ELECTRICAL ENGINEERING LECTURES.

SECOND YEAR.

Dynamo-Electric Machinery.—Current densities and sectional area of dynamo wires; alternate currents; periodicity or frequency; high frequency and low frequency generators and motors; polyphase currents; stationary motors; motor-generators; output and efficiency of dynamos and motors; electro-depositing dynamos; typical modern machines; motor gearing; characteristic curves; transmission of power by alternating currents; central station design; the transformer; modern types of transformer; sub-stations; switchboards; automatic and other regulators; impedance coils.

Electrical Measurements.—Tests of conductivity and insulation resistance of wires and cables; bridge method and deflection method; measurement of resistance by the differential galvanometer; Edelmann bridge method; Ohmmeter method of insulation testing; measurement of electrostatic capacity of submarine cables and underground electric light cables; testing by received currents; potentiometer measurements of potentials and currents; portable testing sets and their connections.

Measuring Instruments and Electricity Meters.—Siemen's dynamometer; Wattmeter; types of ampere meters; electro-magnetic voltmeters; electrostatic voltmeters; hot wire voltmeters; voltmeters for direct currents; voltmeters for alternate currents; engine room voltmeter; ampere balance; Edison electricity meter; Shallenberger meter; Thompson meters; Aron meters; other types of electricity meter; errors in measuring instruments; alternate current measuring instruments; virtual volts; virtual amperes.

Electric Lighting.—House and other lighting; automatic cut-outs, calculations for wiring incandescent lamp circuits; switches and cut-outs; wires and cables; the five-wire system; alternate current arc lamps; choking coil; globes; absorption of light; modern incandescent lamps; typical central electric light stations; power stations; methods of testing electric light circuits; ground detectors; fittings for electric lamps; arc lamp standards; underground mains and conduits; lightning arresters; faults and leakage.

Accumulators or Storage Batteries.—Use of in electric traction; modern types of cell.

Electro-magnetics.—Magnetising force; magnetic induction; permeability; magnetic leakage; eddy currents; hysteresis.

Self induction; mutual induction.

The Electric Telegraph and Telephone.—Circuits; overhead and underground wires; the Morse instrument; the sounder; the Relay; keys; switches; batteries; the submarine cable; signalling instruments; telegraph codes; the history of the telephone; telephone exchange switchboards; induction in telegraph and telephone circuits; faults and leakage in lines; line construction.

Text-books recommended.—"Electric Lighting and Power Distribution," by W. Perren-Maycock (Whittaker); "Electrical Engineering," by Slingo and Brooker (Longmans); "Dynamo Construction," by J. W. Urquhart (Crosby, Lockwood, and Son); The "Electro-magnet," by S. P. Thompson (Spon); "The Dynamo," by Hawkins and Wallis (Whittaker); "Dynamo-Electric Machinery," by S. P. Thompson (Spon); "Telegraphy," by Preece and Sievwright (Crosby, Lockwood, and Son); "Practical Telephone Handbook," by J. Poole (Whittaker.)

SYLLABUS
OF THE
DEPARTMENT OF APPLIED PHYSICS.

. HENRY BARRACLOUGH, B.E. (Syd.), M.M.E. (Cornell), Lecturer (in charge of Department).

THIS department provides systematic theoretical and practical instruction by means of lectures, classes, and Physical Laboratory practice in the various branches of physics of industrial importance. The instruction is given in separate courses of three terms, each course extending over one year. The work of each term is, as far as possible, complete in itself, *e.g.*, in the course on Heat, Light, and Sound, the first term is devoted solely to Heat, the second term to Light, and the third term to Sound. The instruction throughout will aim at training students in the applications of the laws of physics to industry, so enabling them to see how by such applications industrial operations may be improved and rendered the more economical.

COURSES OF INSTRUCTION.

Course A.—Elementary Mechanics.

Course B.—Heat, Light, and Sound.

Course C.—Elementary Electricity and Magnetism.

Course D.—Advanced work (see page 40).

Course E.—Laboratory classes (see page 41).

Students attending Courses A. and C are required to take one term's laboratory work, and are advised to take two, if possible. The subjects treated of cannot be properly learned by merely attending lectures, or reading books.

COURSE A.

ELEMENTARY MECHANICS.

ONE YEAR COURSE.

SYLLABUS.

First Term—Statics.

Introductory.—Relative and absolute motion; velocity, constant, uniformly accelerated and variable; mean velocity; first law of motion; inertia; force; equilibrium; point of application, direction, and magnitude of a force; measurement of forces; gravitation and absolute measure.

Composition and Resolution of Forces.—The parallelogram of forces; the triangle and polygon of forces; rectangular components of a force; resultant of forces acting on a particle; moment of a force with respect to a point; addition of moments; like and unlike parallel forces; resultant of parallel forces, its magnitude, direction and point of application; centre of parallel forces; couples.

Centre of Gravity.—Law of universal gravitation; meaning of centre of gravity of a body; determination of centres of gravity experimentally and geometrically; the centre of gravity of a straight line, square, circle, and triangle; determination of centre of gravity by method of moments; stable, unstable, and neutral equilibrium.

Physical Properties of Matter.—Divisibility, compressibility, and extensibility; density and porosity; elasticity; modulus of elasticity; tenacity; ductility; malleability.

Mechanical Powers and Machines.—The lever—three kinds; the balance; the wheel and axle; capstan; toothed wheels; pulley systems; the inclined plane; the wedge; differential combinations.

Work.—The foot pound, and horse-power; mechanical advantage; principle of work verified in the case of lever, wheel and axle, pulley, inclined plane, and screw.

Friction.—Laws of friction; co-efficient of friction for various surfaces; angle of friction; equilibrium of a body on an inclined plane.

Second Term—Kinetics.

Introductory.—Uniform and variable velocity and acceleration; measure of time, velocity, and acceleration; parallelogram law of velocities and accelerations.

Bodies in Motion.—Laws of motion; formulæ respecting the motion of falling bodies; force; momentum; Attwood's machine; uniform motion in a circle; centrifugal force; the simple and compound pendulums; motion on a smooth inclined plane.

Energy.—Kinetic and potential energy; law of conservation of energy; application of principle to the solution of problems in mechanics; the fly press; rate of work and horse-power.

Collision.—Nature of an impulse; elasticity; direct and oblique collision; energy and impact.

Third Term—Hydrostatics and Pneumatics.

Fluids.—The solid, liquid, and gaseous states of matter; general properties of liquids and gases; laws of fluid pressure; form of the free surface of a liquid at rest; transmissibility of pressure in fluids; the hydraulic press; pressure on sides of containing vessel; centre of pressure.

Principle of Archimedes.—Pressure of liquids on bodies immersed; equilibrium of floating bodies; definition of "density" and of "specific gravity"; various methods of determining the specific gravity of solids and liquids; the density of mixtures.

Pneumatics.—Weight of air; pressure of air; the barometer; various forms of barometers; barometric corrections; Boyle's law; pressure of mixtures of gases; the siphon; the diving bell; balloons; common lift, and force pumps; method of producing continuous discharge; the air-pump; determination of degree of exhaustion; different forms of air-pumps.

For notes on text-books see page 41.

COURSE B. HEAT, LIGHT, AND SOUND.

ONE YEAR COURSE.

First Term—Heat.

Thermometry.—Sensation of heat; definition of temperature; construction and graduation of thermometers; sources of error; maximum and minimum thermometers; pyrometers.

Expansion.—Linear expansion of solids; relation between linear, superficial, and cubical expansion; measurement of co-efficient of expansion; relative and absolute expansion of liquids; expansion of gases; Charles' law; the air thermometer; absolute zero of temperature.

Calorimetry.—Unit of heat; specific heat; calorimeters; latent heat; quantities of heat required to melt solids and vaporise liquids; freezing mixtures; production of cold by evaporation; dew point; hygrometry.

Transference of Heat.—Conduction; temperature gradient; co-efficient of conductivity; convection; currents in liquids and gases; radiation; theory of exchanges; transparency of bodies for radiant heat.

Nature of Heat.—Transformation of visible energy of motion into heat; experiments of Rumford and Davy; Joules' determination of the mechanical equivalent of heat; recent determinations; the first law of thermo-dynamics.

Second Term—Light.

Introductory.—Various theories in regard to the physical nature of light; propagation in straight lines; shadows; eclipses; velocity of light; intensity of light; law of change of intensity with distance; photometry; standards of light.

Reflection.—Reflection of light from plane mirrors; parallel mirrors; inclined mirrors; spherical mirrors; formation of images; size of object and image; conjugate foci; caustics; parabolic mirrors; the sextant; reflecting power of bodies.

Refraction.—Law of refraction at plane surfaces; index of refraction; refraction through a plate; multiple images; critical angle; total reflection; the mirage; refraction through a prism; right-angled prism as a reflector; lenses; formation of images by lenses; construction of the eye; microscopes and telescopes.

Dispersion.—Analysis and synthesis of white light; achromatic prisms and lenses; the spectroscope; refrangibility of various coloured lights; spectrum analysis; physical cause of colour.

Interference.—Sketch of the undulatory theory; Newton's rings; colours of thin plates.

Polarisation.—Double refractors; properties of calc-spar and tourmaline; construction of Nicol prisms; polarisation by reflection.

Third Term—Sound.

Production and Propagation of Sound.—Physical cause of sound; propagation of sound through air; vibration of air particles; sound waves, their frequency and length; intensity of sound in rarefied atmospheres; meaning of the term elasticity as applied to gases.

Speed of Propagation of Sound.—Velocity of sound in air; the effect of changes of elasticity and density on the velocity; effect of changes of temperature on elasticity and density of gases; Laplace's correction of Newton's formula; influence of fog and snow on velocity; velocity of sound in liquids and solids; methods employed for measuring velocity of sound in gases, liquids, and solids; reflection and refraction of sound; speaking-tubes.

Physical basis of Music.—Loudness, pitch, and quality of musical sounds; the diatonic scale; intervals; major, minor, and semi-tones; sharps and flats; the chromatic scale; vibration ratios; determination of pitch; the siren; laws of vibration of rods and strings; use of the sonometer in verifying laws; acoustical interference; beats; harmonics or overtones; quality or timbre of sound; laws of vibrations of air in tubes; longitudinal vibration of rods; open and stopped pipes; sensitive flames; resonance and resonators; analysis and synthesis of compound notes; the principles of harmony.

For notes on text-books see page 41.

COURSE C. MAGNETISM AND ELECTRICITY.

ONE YEAR COURSE.

First and Second Terms.

(The work of the first two terms of this course is arranged for the convenience of the first-year students in Electrical Engineering.)

Magnetism.—Natural and artificial magnets; magnetic attractions and repulsions; magnetic and diamagnetic substances; methods of making magnets; distribution of free magnetism in a magnet; various theories of magnetism; magnetic induction; laws of magnetic force; pole strength and lifting power of magnets; lines of force and the magnetic field; methods of measuring the strength of a magnetic field; terrestrial magnetism; declination, dip, and intensity; variations of the earth's magnetism.

Current Electricity.—Conditions necessary for the production of a current; chemical action in simple voltaic cell; electromotive series; amalgamation; polarisation; description of various batteries in common use; resistance; current strength; Ohm's law; thermal effect of a current; Joule's law; thermo-electricity; chemical effect of a current; electrolysis; Faraday's laws; the voltameter; mechanical effect of a current; mutual attractions and repulsions of conductors carrying currents; solenoids; Ampere's theory of magnetism; magnetic effects of a current; lines of magnetic force in the neighbourhood of a current; Oersted's experiment; various types of galvanometer; the induction of currents; Faraday's law; Lenz's law; the induction coil; the telephone.

In addition to the above, a few lectures will be given dealing with the practical processes carried out in the Physical Laboratory. See page 41.

Third Term.

Electrostatics.—Frictional electricity; electrical attractions and repulsions; theories of electricity; conductors and insulators; electroscopes; frictional electrical machines; charge; potential; laws of electrostatics; electrometers; lines of force; electric field; distribution of electricity on conductors; density; induction; the electrophorus; influence machines, such as the Wimshurst; capacity; dielectrics; specific inductive capacity; the Leyden jar; condensers; atmospheric electricity.

For notes on text-books see page 41.

COURSE D.

Advanced Work.

If a sufficient number of students desire it, advanced courses of lectures will be delivered on each of the subjects treated of in courses A, B, and C. No definite syllabus is laid down for this advanced work, but the lectures will, as far as possible, be arranged to suit the individual needs of the students attending the classes.

COURSE E.

Laboratory Classes.

It cannot be too strongly impressed upon students that it is next to impossible to obtain a good grasp of the subjects dealt with in the department of Applied Physics, unless some time is devoted to experimental work in the laboratory. At least one term's attendance at the laboratory classes is required of students who desire to complete courses A and C. Some of the matters which will be dealt with in these two classes are shown in the accompanying syllabus:—

MECHANICS.

1. The Vernier: its theory; method of reading different forms.
2. The measurement of length: Callipers, micrometers, and wire gauges.
3. The measurement of area: different methods employed; the planimeter.
4. The estimation of mass: use of the balance.
5. The parallelogram of forces: experimental proof.
6. Parallel forces: centre of gravity.
7. The barometer.
8. Boyle's law.
9. The laws of motion: Attwood's machine.
10. The pendulum.
11. Elasticity: Hooke's law; Young's modulus.
12. Specific gravity.

ELECTRICITY AND MAGNETISM.

1. Elementary experiments in electrostatics.
2. Magnetism: fundamental laws and experiments.
3. Fitting up different types of cells.
4. Galvanometers: sine, tangent and mirror.
5. Determination of galvanometer "constant."
6. Proof of Ohm's law.
7. The Wheatstone bridge, and the slide metre bridge.
8. Determination of resistance, E.M.F., and current.

Notes on Text-books.

If Students desire a general elementary text book on physics, the well-known books by Balfour Stewart and Everett will be found satisfactory. It is, however, better to study each branch of the subject from a text book devoted solely to that part. Students will be advised before the lectures begin as to which of these will best suit the work taken up in the various classes.

The following is a short list of some standard works to which reference may be made:—Tait's "Properties of Matter"; Clerk Maxwell's "Matter and Motion" and "Theory of Heat"; Tyndall's "Sound," and "Heat, a Mode of Motion"; S. P. Thompson's "Electricity and Magnetism"; Ewing's "Magnetism in Iron and other Metals"; Stewart and Gee's "Practical Physics"; Glazebrook and Shaw's "Practical Physics"; Glazebrook's "Mechanics and Hydrostatics."

SYLLABUS
OF
MATHEMATICS CLASSES.

NORMAN FITZ, B.E., Teacher.

Technical Arithmetic and Mensuration.

TWO YEARS COURSE.

The object of this class is not so much to teach the rules of Arithmetic as to show the practical uses of Arithmetic in technical questions, and the proper methods of performing calculations peculiar to the various branches of science.

Finance.—Value; price; profit and loss; mixtures; simple and compound interest and annuities; shares and stocks; exchange.

Mensuration.—Unit of length; imperial standard of length; metric standard of length; the metre; derived units; change of length; angles; units of measure; ratios; gradients; curvature and radius of curvature; surface; units of surface; area of plane surfaces; area of the section of a circle; surface of the cone and cylinder; volume of parallelepiped cylinder, cone and pyramid.

Mechanical.—Time; units of mean, solar, and sidereal; local and standard time; speed and velocity; relative speed; the Vernier; angular velocity; speed of turning; space passed over; acceleration; mass and weight; force; specific gravity and pressure; the atmosphere; work and power; moments; mechanical advantage; gravitation.

Geometry, Algebra, and Trigonometry.

FIRST YEAR COURSE.

Euclid.—"Euclid's Elements," Books I to III inclusive; exercises on lines and angles; inequalities of lines, areas, and angles; properties of segments of a line; angles in segments of a circle; simple loci.

Algebra.—Definitions and rules; simple equations; simultaneous equations of the first degree; factors; H.C.F. and L.C.M.; fractions; fractional equations.

Trigonometry.—Measurement of angles; ratios; simple heights and distances and identities.

Text-books.—Hall and Knight's "Elementary Algebra"; Hall and Stevens' "Euclid"; Lock's "Trigonometry for Beginners."

SECOND YEAR COURSE.

Algebra.—Quadratic equations; simultaneous equations of the second degree; indices; surds; ratio; proportion; variation; arithmetical, geometrical, and harmonical progressions; permutations and combinations; the binomial theorem; logarithms.

Euclid.—Books IV to VI inclusive, with modern geometry; maxima and minima; concurrency and collinearity; inversion; loci.

Trigonometry.—Measurement of angles; trigonometrical ratios; ratios for two angles and multiple angles; use of logarithms and tables; solution of triangles; heights and distances; area of polygons.

Geometrical Conic Sections.—The simple properties of the parabola, ellipse and hyperbola.

Text-books.—Hall and Knight's "Elementary Algebra"; Hall and Stevens' "Euclid"; J. B. Lock's "Trigonometry for Beginners"; J. Wilson's "Conics."

SYLLABUS
OF THE
DEPARTMENT OF PRACTICAL SANITATION,
INCLUDING THE
TRADES COURSE IN SANITARY AND GENERAL PLUMBING.

JOHN L. BRUCE, I.A. (Scot.), &c., Lecturer (in charge of Department).
 JAMES DOUGLAS, Teacher of Plumbing. WILLIAM NELSON, Assistant Teacher.

“Practical Sanitary Science is thus embodied in the words pure air, pure water, and a pure subsoil.”—*Galton*.

INTRODUCTORY.

Practical Sanitation.

IN the department of Practical Sanitation, which includes the trades course in plumbing, instruction is given in public health work generally.

The instruction is subdivided into the special courses A, B, and C, and these into special terms, so that those desiring to improve themselves in any branch of the subject may do so by attending one course or one term.

Those qualifying as city surveyors, sanitary inspectors, nuisance inspectors, assistants to a Medical Officer of Health, or cadets in offices dealing with water supply and sewerage should take the courses A, B, and C. Architects, architectural draughtsmen, clerk of works, or plumbers, desiring advanced knowledge, and inspectors of plumbing, draining or water supply should take the courses A and B. Visits to works in progress are made when practicable.

The appliances in the workshops include apparatus for testing the flow of water and air currents; the testing of methods of air, water, and sewage purification and filtration; drain testing, hygrometric measurements, &c.

Practical Plumbing.

This instruction is intended for persons actually engaged in the plumbing trade, those qualifying themselves as inspectors of plumbing or water supply, or for a plumber's license, or for the position of Clerk of Works.

The plumbing workshops are equipped with appliances for lead working, wiping, and soldering; and workmanship is taught by the covering of models of roofs, domes, finials, gutters, sinks, &c., the fitting in position of sanitary appliances, the operations of lead-sheet casting, and of lead burning, or auto-genous soldering.

The course for a Diploma in Practical Sanitation is as follows:—

Introductory or con- current Subjects.	Physics, course B	} During the 1st year.
	Geometry, algebra, and trigonometry, 1st year...	
	Descriptive geometry	} During the 2nd year.
	Chemistry, practical and theoretical, 1st year ...	
Principal Subjects	Physics, course A	} During two or three years.
	Mechanical or architectural drawing	
	Practical sanitation, courses A, B, and C	
Extra Subjects	Geology, section A	} During 2nd and 3rd or subsequent years.
	Geometry, algebra, and trigonometry, 2nd year..	
	Building construction, 1st year, or physics, course C, 1st and 2nd terms	

The following subjects, although not required for the diploma, are recommended as most useful to students in practical sanitation:—Model and object drawing, applied mechanics, agriculture, 1st year.

COURSES OF STUDY.

Practical Sanitation.

J. L. BRUCE.

COURSE A.

Practical Lighting, Heating, Cooling, and Ventilation.

FIRST TERM.

Lectures.—Air, gases, and vapours in relation to health, and to lighting, heating, cooling, and ventilation.

Practical Work.—Measurement of air currents, and of temperature, moisture, and impurities; flow of air and gas in pipes and ducts.

SECOND TERM.

Lectures.—Lighting, heating, and cooling, practically applied, and the designing of systems.

Practical Work.—Measurement of lighting power of different gas-burners, illuminants, and reflectors, and of the vitiation of the air produced by illuminants; heating power of various warming apparatus for air and water, and using gas, oil, or solid fuel; cooling power, of liquefaction, of evaporation, of various materials, and of frigorific mixtures as bearing on the absorption of heat for cooling purposes.

THIRD TERM.

Lectures.—Ventilation, practically applied, and the designing of systems.

Practical Work.—Measurement of the efficiency of ventilating systems and appliances, and of combined warming, cooling, and ventilating appliances; method of making a complete test for report.

COURSE B.

Water Supply, Sanitary Fittings and Drainage, Sewage and Refuse Disposal, on a small scale.

FIRST TERM.

Lectures.—Hot and cold water supply, practically applied, and the designing of systems.

Practical Work.—Measurement of the flow of water in pipes and channels; simple tests for good water; testing the action of bends, elbows, taps, and surfaces on the flow of water; efficiency of hot water supply apparatus heated by gas, oil, and solid fuel; testing of hot water supply circulation fittings.

SECOND TERM.

Lectures.—Sanitary fittings and wastes, and the designing of systems.

Practical Work.—Measurement of the self-cleansing flow in various pipes and forms of fittings; syphonic action of flushing discharges; hot and cold water mixtures; action and efficiency of automatic flushing tanks, of waste-not and loose valve taps, and of flushing cisterns.

THIRD TERM.

Lectures.—Drainage, sewerage, and refuse disposal; the designing of systems.

Practical Work.—Measurement of self-cleansing flow in drains and drain-traps; construction of pipe drains and fittings; effect of junctions on flow; efficiency of drain ventilators; practical drain testing.

COURSE C.

Municipal Sanitation, Public Water Supply, Sewerage and Sewage Disposal, Disinfection and Nuisance Prevention.

FIRST TERM.

Lectures.—Public water supplies; designing and working of systems.

Practical Work.—Generally same as in First Term of Course B, and testing of taps, ball valves, and meters, and of water-waste preventing appliances.

SECOND TERM.

Lectures.—Public sewerage and sewage disposal; designing and working of systems.

Practical Work.—Generally same as Second and Third Terms of Course B; testing of materials for sewerage purposes; efficiency of sewage filters and filtering materials; simple tests for defective ventilation in sewers.

THIRD TERM.

Lectures.—Nuisance prevention—disinfection, cold stores, smoke prevention, street paving and cleansing, and disposal of garbage; street lighting, designing of systems, and working of same.

Practical Work.—Generally same as that in Course A, as applied more particularly to Municipal purposes.

Simple Surveying, Levelling, and Setting out of Work.

In addition to the lectures, practical field lessons are given in the College quadrangle to the students on Saturday afternoons during the terms in making a chain survey by offsets; making a rough traverse survey with prismatic compass or box quadrant; levelling with the levelling instrument and staff, and closing the survey; rough contouring with the clinometer, or Abney's, or other pocket level; setting out work on the ground and laying off curves, polygons, &c., by offsets or other methods.

TEXT BOOKS.

Course A.—Douglas Galton's "Healthy Dwellings"; Box's "Practical Treatise on Heat"; Billing's "Ventilation and Heating"; Baldwin's "Hot water Heating and Fitting."

Course B.—Box's "Hydraulics"; Hellyer's "The Plumber and Sanitary Houses"; Maguire's "Sanitary Drainage and Plumbing"; Clarke's "Lectures to Plumbers."

Course C.—Staley and Pierson's "Separate System of Sewerage"; Santo Crimp's "Sewage Disposal Works"; Burton's "Water Supply of Towns"; Bulnois' "Road-making"; Jones' "Refuse Destructors"; Usill's "Practical Surveying."

PRACTICAL PLUMBING.

TWO YEARS COURSE.

Students should attend the Plumbing classes for not less than two nights per week, and this entitles them to attend the workshop lecture or experiment classes.

Students who have attended the Practical Plumbing class for two years should attend the Courses A and B in Practical Sanitation.

FIRST YEAR COURSE.

Lectures.

JAMES DOUGLAS.

Working of lead ; composition of solders. Making lead sheets and pipes ; cast lead ; cutting out lead and other sheet-metals ; rules to find the length of pipes in spirals and coils, &c. Various forms of traps, object of traps and vent-pipes. Differences between wiped and other solder-made joints ; proportions ; soft-metal pressure joints ; unions and other methods of jointing. Object and action of cesspools in gutters, and bell mouths to overflows ; how to find the cubic feet or gallons in any size or shape of tank, and the weight of the water, pumps, &c.

Practical Work.

JAMES DOUGLAS.

Making, cleansing, and application of solders ; cutting out the lead for, and seaming "made" pipes. Cutting out, dressing, and making traps. Making wiped-joints ; practical points ; fitting, soiling, cleaning, steadying, and wiping the joints. Various methods of bending small, "made" and "drawn" pipes. Cutting out, preparing, and fixing ridging and hips in various methods ; expansion joinings and roof-work. Bossing required in roof-gutter work, &c., cutting out material ; forming over and under cloak of drips, &c.

SECOND YEAR COURSE.

Lectures.

J. L. BRUCE.

The flow of water in pipes ; head and pressure ; rules to find the delivery of water in pipes ; effect on flow of elbows and bends in water supply and waste pipes. Strength of pipes, joints, cylinders, tanks, &c., of various metals and forms ; taps and valves, their purpose and principle ; jointings for different metals, and for metals and earthenware. The action of water flushes on traps ; syphoning and blowing out ; disconnection ; interception ; safety or vent pipes ; principles on which safe arrangements of parts depend ; anti-syphon traps ; drains ; house fittings, &c. ; ventilating cowls. Maximum rainfall as influencing sizes of gutters, downspouts, and overflows ; rules and tables ; water supply from roof-water, size of storage tanks ; water needed for household and other purposes ; rainfall in different parts of the Colony, as affecting roof-water storage. The circulation of hot water in pipes ; how to determine the sizes of pipes required ; necessity and proper position for air-valves, vent pipes, &c. ; expansion joints ; causes of explosions ; water level and pressure indicators ; rules for sizes of boilers and circulating tanks ; precautions against scalding ; general rules ; differences between hot water supply and hot water heating apparatus ; high and low pressure system of water heating ; size and lengths of pipes required ; steam heating ; gas water-heaters ; heating power of fuels. The action of waters on lead ; simple tests

for lead in water; pumping of water; power required; size of pumps for man-power, &c.; proper size of suction, delivery pipes, and air vessels; varieties of pumps; hydraulic rams—sizes and water required; waste-not cisterns and valves, automatic flushing cisterns and tanks; overflow and safe pipes.

Practical.

JAMES DOUGLAS.

Wiping; wiping lead to brass, &c.; square-wiped joints; repairing of taps and valves. Fitting together of wastes, vents, &c., where numerous pipes join; how to get the several parts fitted correctly and joined securely. Making and fitting in position wastes and vents. Cutting out with least waste the lead for covering flats, domes, and other irregularly shaped forms; how to make the various forms of rolls, joinings, and fixings for flats, domes, gutters, and chimneys; bossing out and dressing the lead covering for ornamental roof finishings as finials, crestings, rainwater heads, &c. Practical points to be attended to in fitting up hot and cold water supply and water-heating arrangements to secure a water-tight, reliable, and efficient job, illustrated by making and fitting in position a small hot-water supply apparatus.

SPECIAL ADVANCED COURSE.

The lectures and the practical work in this grade are a continuation and extension of the previous two years' work.

Experimental Workshops.

J. L. BRUCE.

Testing for sewer gas in water and air; methods of testing drainage and waste-pipe arrangements; experiments on the efficiency of water seals; experiment on syphoning in traps differently formed and fitted, and on ventilating currents induced by the discharge of water in waste-pipes; action and efficiency of ventilating cowls; flow of water in bends and junctions at various angles; testing of valves, waste-not cisterns.

TEXT BOOKS.

Thos. Box's "Hydraulics"; Clark's "Lectures to Plumbers"; Smeaton's "Plumbing and Drainage"; Maguire's "Sanitary Drainage and Plumbing."

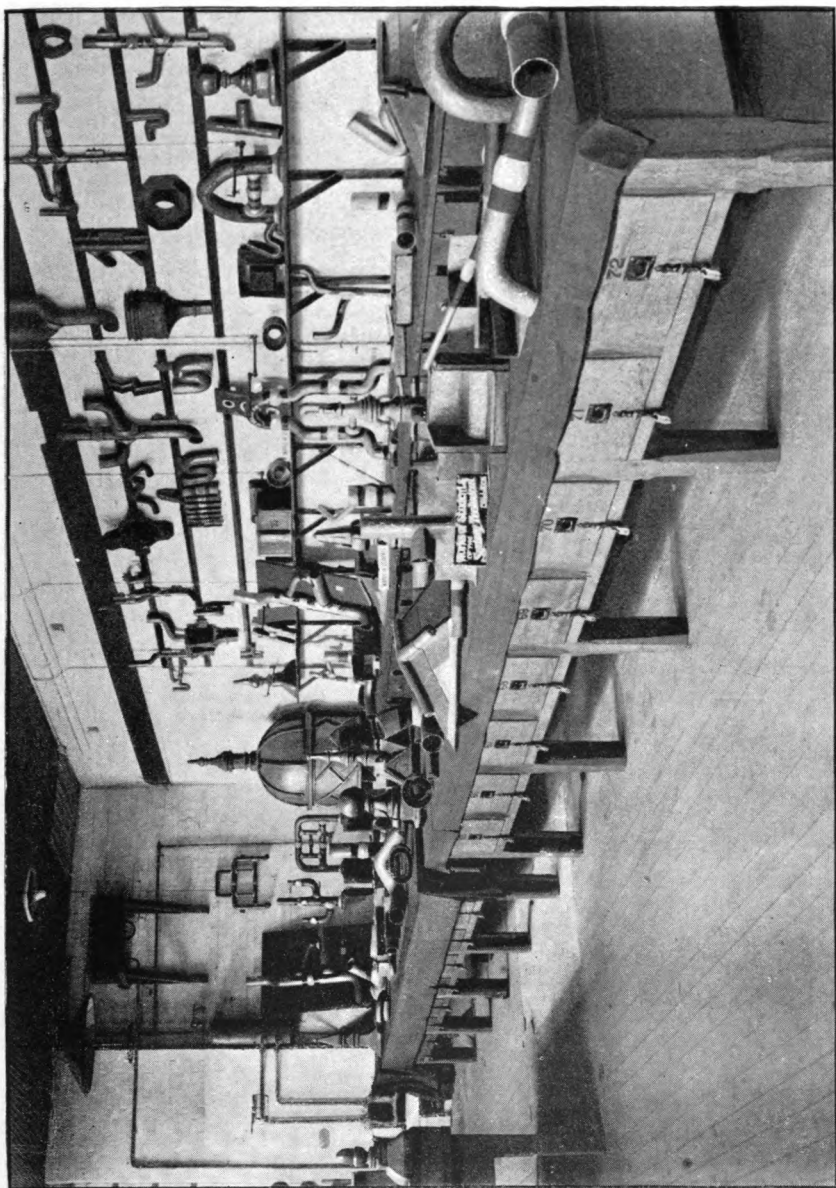
SANITATION DEPARTMENT—EXAMINATIONS FOR.

Masters Plumbers' Diplomas; Drainers' Certificates, and Certificates of Competency to lay on water.

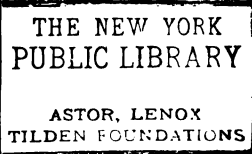
EXAMINING BOARD.

President: JOHN L. BRUCE, Lecturer in Practical Sanitation; CYRIL BLACKET, Lecturer in Architecture; JAMES DOUGLAS, Teacher of Plumbing.

Examinations for *Diplomas of Competency as Master Plumbers* are held during the session, commencing on the third Wednesday of each month (provided that at least three entries have been made a week previously). These Certificates are issued in three grades. Satisfactory or ordinary, first grade, and Honours pass.



PLUMBERS' WORKSHOP.



These examinations extend over three days and include a written examination as to principles, sanitary sketches showing arrangements of pipes and fittings, and a practical test in lead working, wiping, and soldering.

To obtain a "Satisfactory" pass candidates must secure 65 % of the possible marks at each day's examination, and for a "First grade" pass an average of 75 %, and produce evidence of having been seven years at the trade.

The "Honours" pass demands an average of 85 % of the possible marks in each of the three days' examination, and for this grade candidates must produce evidence of a record of practical experience as journeymen in the conduct or execution of good class work extending over at least seven years.

Students passing in "advanced" plumbing at the ordinary annual college examinations shall be entitled to receive the above diplomas (carrying a license), provided that their papers, drawings, and workmanship show the percentages of marks as stated above, and if they can produce evidence of the record of experience required; but in all such cases the Examining Board may require a supplementary examination on any point, in their opinion, not sufficiently answered at the ordinary annual examination.

Examinations for *Drainer's Certificates* are held on the first Monday of every month during the session, and include a practical workmanship test in drain-laying to a stated fall, bedding, jointing, and insertion of branches and traps, followed by questioning as to the proper arrangement of house-drainage, the Metropolitan District Water and Sewerage Regulations and By-laws on the subject, and the interpretation of plans.

Examinations for *Competency to Lay on Water* are held on the first Wednesday of every month during the session, and include a practical test in the making of straight and branched wiped joints on lead water-pipes, followed by a written examination as to the Water Service Regulations and By-laws of the Metropolitan Board of Water Supply and Sewerage, and the purpose and proper arrangement of various water-fittings. Candidates for licenses to lay on water in towns under the jurisdiction of the Metropolitan Board must pass this examination. The Pass Certificate in this examination also forms a guarantee of competency availed of by Local authorities throughout the Colony in granting licenses to do work of this class under their control.

Particulars as to dates and entry fees, &c., may be obtained from the Hon. Secretary at the Technical College Office.

These Diplomas and Certificates of Competency are accepted throughout the Colony, and are recognised in several of the Government departments. Candidates for licenses as plumbers or as drainers, and for licenses to lay on water under the Metropolitan Board of Water Supply and Sewerage must pass these examinations before the Board's license will be issued to them; and the master plumber's examinations are also accepted by the Hunter District Water Supply and Sewerage Board, by the authorities in Melbourne, Wellington, and Christchurch, New Zealand, as qualifying for their license without further examination.

These examinations are usually conducted at the Sydney Technical College, but in special cases arrangements will (if possible) be made to hold them locally.

For a diploma in architecture, students must attend the classes, and pass the prescribed examinations. The course for the diploma is as follows :—

Introductory or Concurrent Subjects.	Freehand Drawing.....	One year.
Principal Subjects	Architectural Drawing	Three years.
	Architectural History	
	Building Construction	
Extra Subjects	Mathematics	One year.
	Design	
	Sciography	
	Perspective Drawing	
	Carpentry and Joinery	Two years.
	Plumbing or Masonry, and Bricklaying ...	
	Quantity Surveying	
	Modelling	
	Physics (Heat, Light, and Sound)	
	Descriptive Geometry	

For certain special subjects, students in the building construction class will attend for instruction in the carpentry, masonry, or testing rooms.

In order to obtain a first year's certificate in building construction, students must have a first year's certificate in architectural drawing.

DETAILED SYLLABUS.

FIRST YEAR.

Architectural History.

Students will study the history of architecture from the earliest times to the present date, in a rudimentary manner, taking notice of the main distinguishing features of each style, and the causes which developed one style out of another.

FIRST YEAR.

Architectural Drawing.

The use of instruments; practice in copying drawings; study in the main features of Classic and Gothic styles.

FIRST YEAR.

Building Construction.

In an elementary way the use of materials, together with the technical names and descriptions of the various parts of a building.

SECOND YEAR.

Architectural History.

The history of architecture will be gone through again as far as concerns original styles, giving details and formulæ for the various orders and styles, enabling the student to correctly reproduce any Classic, Gothic, Egyptian, Romanesque, or other feature in detail.

SECOND YEAR.

Architectural Drawing.

Inking and coloring, preparing working drawings from sketches, and the orders of Classic and Gothic in detail.

SECOND YEAR.

Building Construction.

The manufacture of materials, trade sizes, weights and means of supply. The ordinary systems of roof construction, walling, strutting, &c., sufficiently to enable the student to understand the construction of every-day buildings.

The third year's course will be open not only to regular students but also to advanced pupils in architects' offices, clerks of works, foremen in builders' shops, &c.

Quantity Surveying.

The cost and measurement of materials and labour; tenders per schedule; estimating by cubing; profits, risk, security bonds; examples from plans and specifications.

THIRD YEAR.

Architectural Principles and Appliances.

The third year's course of Building Construction and History are combined in these lectures.

The application of various styles to modern materials, specification writing, and formula for designing—Sydney Improvement Act. Systems of underpinning, &c.

THIRD YEAR.

Architectural Drawing.

Original design, working details, artistic finish to drawings for competition, &c.

Afternoon classes will be held for both architectural and building trades' drawing, which will include, amongst other studies, the main features of Classic, Gothic, Byzantine, and other architecture, so necessary for the artist and decorator.

It is expected that lectures will occasionally be given by specialists, irrespective of those by the regular lecturers.

CLASSES FOR BUILDING TRADES.

A special drawing course of one year for building trades students is provided in the architectural drawing class, specially arranged for the particular trade each student must follow.

MASONRY, BRICKLAYING, STONE AND MARBLE CARVING, AND LETTER CUTTING.

FIRST YEAR.

Use of tools; names and descriptions of various classes of work; methods of finish; and all preliminary practical work.

SECOND YEAR.

Setting out work; making and cutting templates, and all work of an advanced type.

The masonry course will embrace the cutting of moulds, and working in Oamaru or other stone all classes of finish mouldings and arches.

Students may take up any one section. One evening per week will be devoted to theory and drawing under the teacher of architectural drawing, and one evening to practical work under the teacher of the class.

In order to obtain a first year's certificate a student must have a first year's certificate in architectural drawing.

CARPENTRY AND JOINERY.

In order to obtain a first year's certificate in Carpentry, a student must have a first year's certificate in Architectural Drawing.

FIRST YEAR.

The use of the carpenter's rule; measuring and ordering timber; description and purposes of the principal woods used in buildings; cutting up and seasoning by natural and artificial means; decay of timber and its preservation; construction and use of plain scales and scale of chords; setting out and measuring angles; explanation of drawings supplied by architects, including plans, elevations, sections, and details; setting out work from drawings for practical working.

Tools.—The names, forms, uses, and management of the principal hand-tools; bench moulding and other planes; the pitching of irons for planes;

finding the form of moulding-irons for machines; hand and machine mortising tools; setting out work for hand or machine; cutting out with circular, band, and fret saws.

Flooring.—The names, forms, and construction of single, double, and framed floors; supports; jointing joists, large beams, and girders; strengths; neutral axis; proportion of tusk tenons; trussing and strengthening girders; story-posts; cast-iron connections; corbel and saddlepieces; notching, cogging, halving, lapping, fishing, and scarfing timbers; stiffening floors by herring-bone strutting, bridging, &c.; trimming joists; preparing for ceilings, hearths, trimmer arches, &c. Floorboards: Straight and broken, heading and other joints, secret or blind nailing; borders, balcony floors, &c.

Roofing.—The names and forms of common roofs—Lean-to, span, or hip; jointing common rafters, jack rafters, and hip on wall, ridge, pole-plates, collar-ties, &c.; framing, cutting, and jointing, king and queen post trusses; Mansard and De Lorme roof trusses; preparing for plumber and slater work; forming rolls; valleys, gutters, drips, and cesspools.

Doors.—The names and forms of doors—Ledge and frame ledge, braced, panel doors, double margin, sash or half-glass doors, French casements, external doors and fanlights; proportions of styles, rails, mountings; proportion of tenons to thickness of stuff; preparing for panels of wood or glass, cramping up, cleaning off and moulding doors; making and fixing solid door-frames, jamb-linings, architraves, &c.; hanging doors and fanlights, fixing other ironmongery, &c.

Windows.—Making solid box or cased frames; fixing and finishing windows to fit brickwork with hand mouldings, single or double faced architraves, and moulded window boards; making Venetian windows and shutters; cottage casements; fixing ironmongery.

Joints.—Plain butt or shot; dowelled; grooved and tongued; slip-tongued; ploughed; slip-feathered; cross-grooved; beaded or V; dovetail and dovetail key; common and secret lap; secret and keyed mitre; hammer-headed key; clamp and mitre clamp. *Tenons.*—Mortise and tenon; stub; stump; double; notched; dovetail; secret or fox-wedged, &c. *Beads.*—Quirk and double quirk; return; flush; torus; coched; rebating; chamfering; scribing; housing; filleting; reeding; fluting, &c.

Centres, &c.—Making, fixing, and striking centres for segment; circular, elliptical, and Gothic arches; street hoardings; scaffolding; shoring. *Partitions.*—Stud; brace; truss.

Weather-boarding.—Framing and fitting up; finishing external angles; barge and fascia boards; framing and hanging gates.

SECOND YEAR.

Bevels.—Making boxes, troughs, and hoppers; bevels on hip roofs; triangular ventilators; hip skylights and lantern lights.

Circular Work.—Development of geometrical solids; kerfing, bending, laminating, veneering, forming and building up; intersections of straight or circular mouldings; making mouldings or pediments over doors, &c.; making circle on circle doors and windows; splayed door and window linings, with circular or elliptical heads; centres for stone or brick work; form of rafters, ribs, and hips for circular roofs of various descriptions; niches; groined, cored, and bracketed ceilings, &c.

Windows and Window-shutters.—Making and fixing dormer, bay, and oriel windows; framing and finishing dead, lifting, folding, or sliding shutters.

Shop and Office Fittings.—Selection of woods; shop window stands; brackets; angle and lapped bars; circular counters; shelving; desks; enclosures; silvered glass; wood and glass in counter, centre and wall cases, on air-tight principle; curved cases; trays; serving boards, &c.

Glasswork.—Jointing external woodwork; throating for water drips and bars; preparing framing for glass in conservatories, greenhouses, skylights, and lanterns.

Reference Books.—*Tredgold's "Carpentry"; *Newland's "Carpenter and Joiner's Assistant"; Colling's "Circular Work in Carpentry and Joinery"; *Creswell's "Handrailing and Staircasing"; *Colling's "Handrailing."

*These books may be read in the Reference Library, Technical College.

STAIRCASING AND HANDRAILING.

ONE YEAR—FOR ADVANCED STUDENTS.

Straight, dog-legged, open newel, platform, circular and spiral stairs; proportion of treads to risers; forming straight and circular strings; square and circular wells; landings; jointing treads and risers; fixing carriages, rough bracketing, soffits, &c., finding the length of newels and balusters, and setting out for mortises and turning; forming bullnose, half-bullnose, curtail, scroll, and other circular steps. *Handrailing.*—Names and forms of rails; methods of jointing; drawing out and making wreathed and straight rails, squared up or moulded; obtaining lines for the face moulds of platform stairs from the pitch-board, also constructing falling moulds from tangents, or *vice versa*; drawing out face models by development of tangents for side wreaths; working wreaths, face moulds for platform stairs with centre tangent level, risers at springing in wells less or more than a tread wide, straight continued spring; moulds for easings, ramps, knees, mitre-caps, scrolls, &c.; face moulds for wreaths over quarter-space and other landings, starting from third flight from level floor; wreaths over quarter and half space of winders, also face moulds for circular and spiral stairs.

CABINET-MAKING.

Tools, and their application; description of woods and veneers used in cabinet work; glue and its uses; jointing, dovetailing, mortising, and tenoning; inlaying; preparing groundwork for veneer; preparing and laying veneer; cross-banding; marquetry work; buhl work; the practical setting out of working drawings.

The work in the carpentry, joinery, and cabinet-making classes is facilitated by the following machines—all of which are driven with a Tangye engine, 8-horse power, and a 10-horse power boiler; Fay's No. 2 American solid frame patent variety wood worker, for planing out of wind, jointing, cornering, chamfering, tapering, mitring, rebating, ploughing, ripping, tonguing and grooving, raising door-panels, circular mouldings, and all kinds of sash and door work, boring, &c.; small panel planing machine, planes from $\frac{1}{2}$ in. to 6 in. in thickness, 15 in. wide; small saw bench, fitted with two saws, 14 in. to rise and fall in bench; large saw bench (fitted as above); two hand sawing machines, with five saws, from $\frac{1}{2}$ in. to $\frac{3}{4}$ in., for cutting sweeps and circular work; one patent fret-saw for cutting brackets for stairs, &c.; large grind-stone, 3 ft. by 6 in., steam power; small grind-stone, 2 ft. by 4 in., hand power; set emery wheels, six in number, for grinding moulding irons; vertical edge moulding, or shaping machine.

NOTE.—Students who have had experience of machinery are taught the uses of same, and supervision is given by the teacher both for purposes of instruction and precaution against accident.

DAY CLASS.

A limited number of students are taken in the day class at a fee of £1 per term.

JOINERY CLASS.

One year for advanced students.

There is a special class for seniors only for the higher branches of advanced joinery.

SYLLABUS

OF THE

DEPARTMENT OF ART.

J. B. WRIGHT—Lecturer (in charge of Department).

Teachers:—

G. A. THOMAS.	A. G. RYD.
G. H. AUBOUSSEAU.	D. EDGAR.
H. BASTINGS.	G. MACINTOSH.
A. E. RICH.	J. A. PEACH.
Miss R. BLAKEMORE.	Miss E. I. BROWN.

THIS Department provides a systematic course of instruction in Drawing, Painting, and Modelling, and is carried on by a staff of trained teachers, whose aim is to develop in the students under their care self-reliance, individuality, and originality; to assist those who desire to make a knowledge of Art a part of their general education; also to give facilities for the training of persons who intend to adopt Art as a profession, or to include it in their general qualification as Teachers in public, elementary, or other schools.

Subjects composed in the course of instruction under Art:—

Freehand Drawing	From the Cast of Ornament, Birds, Animals, &c.	3 years.
Model and Object Drawing	From Rectilinear and Curvilinear Figures... ..	2 years.
Geometry	Practical Plane, Solid, and Descriptive	2 years.
Perspective	Parallel, Angular, Oblique, and Direct	2 years.
Sciography	Orthographic and Radial	1 year.
Plant Drawing	From Nature, in Outline and Colour	2 years.
Design	In the Flat, Relief, and Round	3 years.
Still Life	Painting Fruit, Flowers, &c., from Nature... ..	2 years.
Anatomy (Artistic)	Studies of the Human Figure	1 year.
Antique	From the Cast in the Round and Relief	2 years.
Life	From the Semi-nude and Draped Figure	2 years.
Landscape	From Nature, &c.	2 years.
Architecture	The Orders of Architecture	1 year.
Modelling	Ornament	3 years.
Do	Antique	2 years.
China Painting	Painting on Vases, Plaques, Tableware, &c.	2 years.
Casting	Waste and piece moulding in Plaster, &c.	2 years.
*Pottery	Terra-cotta, Making, Glazing, and Firing... ..	2 years.

The course of instruction under Art is arranged progressively and students are advised to conform to the course as laid down.

ASSISTANT TEACHER'S CERTIFICATE (C).

TWO YEARS COURSE.

Obtainable upon passes in the following subjects:—Freehand and Model Drawing, 1st and 2nd years, Geometry, Perspective, Design and Plant Drawing, 1st year.

First Year.	Second Year.
Freehand Drawing, 1st year.	Freehand Drawing, 2nd year.
Model Drawing, 1st year.	Model Drawing, 2nd year.
Geometry, Practical and Solid, 1st year.	Perspective, 1st year.
Design, 1st year.	Plant Drawing, 1st year.

* This class is not actually in operation, but its formation will be considered when a sufficient number of intending students apply.

TEACHER'S CERTIFICATE (B).

TWO YEARS COURSE.

Obtainable upon production of (C), and pass in the following subjects:—
Geometry, Perspective and Design, 2nd year; Freehand Drawing, 3rd year;
Drawing from Life, 1st year; Modelling Ornament, 1st year.

First Year.

Freehand Drawing, 3rd year.
Drawing from the Antique, 1st year.
Geometry, 2nd year.
Design, 2nd year.

Second Year.

Drawing from the Antique, 2nd year.
Drawing from Life, 1st year.
Perspective, 2nd year.
Modelling Ornament, 1st year.

ART MASTER'S CERTIFICATE (A).

THREE YEARS COURSE.

Obtainable upon production of (B), and pass in the following subjects:—
Drawing from Life, 2nd year; Still Life, 1st and 2nd year; Modelling from
the Antique, 1st and 2nd year; Anatomy (Artistic), Sciography and Casting,
each 1st year.

First Year.

Modelling Antique, 1st year.
Still Life, 1st year.
Anatomy (Artistic).
Sketching from Nature, 1st year.

Second Year.

Modelling Antique, 2nd year.
Drawing from Life, 2nd year.
Still Life, 2nd year.
Modelling from Life.

Third Year.

Modelling from Life.
Sketching from Nature, 2nd year.
Architecture, 1st year.
Sciography, 1st year.
Casting, 1st year.

TO OBTAIN A DIPLOMA IN ART

A student will have to obtain Certificate (A) in the First Grade and pass
in one of the following Applied Art subjects:—

Modelling Ornament, Pottery (Terra-cotta, &c.), China Painting, Stone and Marble Carving, Wood Carving, Art Decoration, Repoussé Work, Bent Metal Work,	}	Applied Arts.
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A student may attend a course of instruction in any subject under Art,
and on passing a satisfactory examination, together with the accessory
studies as stated under their respective heads, shall be granted a certificate
to that effect.

FREEHAND DRAWING.

FIRST YEAR.

Drawing in pencil from flat examples in outline, symmetrical forms and
simple curves, outline from the cast, shading from the casts of ornament
and natural foliage, drawing from memory.

SECOND YEAR.

Drawing in pencil, crayon, or charcoal from flat copies in outline, advanced. symmetrical forms, scrolls, volutes, tangential composition of lines, &c., proportional drawing, &c., outline from the cast in oblique positions, shading from the cast of ornament in high and low relief.

THIRD YEAR.

Advanced ornament, in high relief and the round, ornament from the antique, birds, animals, fishes, &c. Painting in monochrome, either in oil or water colours. Memory drawing.

To obtain a certificate in the above a student must also obtain passes in the first year each of Model Drawing, Geometry, Perspective, and Modelling.

NOTE.—The primary object of these classes is to assist artisans of both sexes, and persons connected with mechanical industries, to acquire lightness of hand, and facility in the use of a pencil, so as to enable them to place legibly and intelligibly upon a sheet of paper any piece of work, ornament, or other object they may wish to describe.

Text-book :—W. E. Sparkes' "How to Shade from Models."

Book for Reference :—E. R. Taylor's "Elementary Art Teaching."

MODEL AND OBJECT DRAWING.

FIRST YEAR.

The drawing from wire models, including all simple geometrical solids, as cube, prism, pyramid, cone, cylinder, and sphere. Drawing from simple groups of models, indicating slight light and shade. Drawing from common objects.

Text-book :—Nesbitt and Brown's "Model Drawing."

SECOND YEAR.

Drawing from more advanced groups of models, indicating fully light, shade, and shadows. Groups of common objects in crayon, charcoal, Indian ink, or sepia. Constructional models of buildings and machinery.

The above is a most useful course of drawing, embracing a geometrical, perspective, and freehand training. By studying model drawing systematically the eye, hand, and mind are educated together, and for all those who wish to become rapid and true sketchers, either from nature or otherwise, it is of the first importance.

Text-book :—W. E. Sparkes' "How to Shade from Models."

To obtain a certificate for Model Drawing a student will have to pass the first year each of Geometry, Perspective and Freehand Drawing.

PRACTICAL PLANE AND SOLID GEOMETRY.

SYLLABUS.

FIRST YEAR.

Problems relating to straight lines. Proportional division of lines. Construction of triangular and quadrangular figures. The construction of regular polygons by any general method, together with their inscribed and circumscribed circles. Construction of irregular polygons from given sides, diagonals, and angles. Reduction and enlargement of plane figures. Construction of plane scales. Elementary construction of the ellipse. Simple problems on area. Miscellaneous simple problems relating to lines and circles. Pattern Drawing.

Solid Geometry.—Problems on Plans, elevations, and sections of simple solids.

Practical plane geometry is a course of drawing directly useful to all those who have to make drawings of any kind, and is indispensable to the art workman and designer. During the course hints will be given to the students illustrating the direct application of many of the geometrical problems for trade and professional purposes.

To obtain honors in the examination of the above subject the student will have to answer satisfactorily the problems set in Solid Geometry.

Text-books.—Morris's "Geometrical Drawing for Art Students"; Gill's "Imperial Geometry" (Section I).

SECOND YEAR.

Plane Geometry.—The construction of plane and diagonal "scales" to different linear units, English and Foreign. Proportional division of lines. Construction for mean, third, and fourth proportionals, and for harmonic mean. Construction of polygons from adequate conditions of sides, angles, area, or perimeter. Miscellaneous problems relating to lines, circles, and plane figures. The delineation of plane curves, such as the ellipse, parabola, hyperbola, cycloid, spirals, &c. Problems illustrating the application of Plane Geometry, as arches, sections of mouldings, Gothic tracery, parquetry, and geometric design.

Solid Geometry.—The principles of projection. Definition of terms in general use. Simple problems relating to lines and to planes. Plan and elevation of simple solids resting on the H.P. Plan and elevation of simple solids having one edge in the horizontal plane, and an adjacent face inclined at a given angle. Sections of solids by vertical and horizontal planes. Miscellaneous problems relating to lines and planes.

Graphic Arithmetic.—The representation of numbers by lines. The multiplication of numbers by construction. The division of numbers and the determination of the square root of numbers by construction.

Text-books.—Gill's "Imperial Geometry" (Section II); Burchett's "Practical Plane Geometry"; Angel's "Plane and Solid Geometry" (Elementary).

THIRD YEAR.

Plane Geometry.—Construction of plane figures from different data. Construction from different data of the ellipse, parabola, hyperbola, their tangents and centres of curvature. Delineation of various curves in mechanics. The cycloid, trochoid, epicycloid, hypocycloid, &c., with their tangents, &c. The evolute and involute of the circle, &c.

Solid Geometry.—Projection of the cube, prism, pyramids, tetrahedron octohedron having given—1st, a plane connected with the solid, and a line lying in that plane; 2nd, two lines connected with the solid, &c. Sections of the above solids by vertical and inclined planes. Problems relating to the sphere, cone, and cylinder. Representations of those solids in given positions and in contact. Determination of tangent planes to them. Intersection of their surfaces when variously combined or the interpenetration of solids. Delineation of the simple helix. The square and V-threaded screw. Simple problems in cast shadows. Principles and practice of isometric projection.

A thorough acquaintance with the above will well repay the engineering or architectural student for the labour he may bestow on the subject. No part of a building or drawing can be laid down or understood without the assistance of practical geometry, nor can any mechanical employment in engineering or building departments be conducted without some assistance from this branch of science.

Text-books.—H. Angel's "Advanced Practical Plane and Solid Geometry"; E. W. Tarn's "Practical Geometry."

Students are advised upon entering for geometry to take the first year's freehand drawing.

The Art student's certificate will be granted upon a pass for the second year, and will be known as the Art Geometry Certificate.

Students, other than Art, will be required to pass in the full course as laid down, their certificates being known as Science and Art Geometry.

PRACTICAL PERSPECTIVE.

FIRST YEAR.

(Section I.)—Problems in parallel and angular perspective, including points situated on or above the ground-plane. Lines of given length situated on the ground-plane. Plane figures placed horizontally and vertically. Simple solids placed in various positions. Examples of the use of accidental vanishing points.

(Section II.)—(Direct Method.)—This is a special course laid down for Architectural, Mechanical, and other draughtsmen, working from plan and elevation without the use of measuring points, and includes parallel and angular perspective. Placing into perspective the interior and exterior of buildings, parts of machinery, &c., and the use of the centrolinead.

SECOND YEAR.

(Section I.)—Advanced problems in angular perspective, including polygonal plane and solid figures. Curved lines, arches, &c. Problems in oblique perspective. To find the vanishing line of any plane inclined upwards or downwards, circles, and other geometrical plane figures lying in planes ascending and descending from the spectator. Fractional measuring points. Projection of shadows cast upon plane, inclined, or curved surfaces by sun or luminous point. Reflection of objects in horizontal, vertical, or inclined reflecting planes, &c.

(Section II.)—Advanced studies in perspective, accidental vanishing points for pediments, &c. Placing in perspective crescents of buildings; series of streets leading to a square. Bird's-eye views of asylums, colleges, or any spacious areas or courts, &c. Perspective of arcades, groined ceilings, parts of machinery. Cast shadows of objects from three positions of the sun or from luminous points. Reflection of objects on water, also to obtain the position and images of objects on mirrors. The colouring of drawings.

NOTE.—Sections I and II form two distinct courses. A student may take either both for his course, but can only be examined in one section in the same year.

This study, coupled with geometry, is the basis of all object drawing. Its importance cannot be overrated. To the architect, engineer, art-workman, and painter it is indispensable. Students wishing to follow this course must either have passed the first year in practical geometry or be attending that course. They are advised also to take the first year Freehand or Model Drawing.

Books of Reference.—Dennis' "Second and Third Grade Perspective"; R. Burchett's "Linear Perspective"; Alfred Denyer's "Linear Perspective."

SCIOGRAPHY.

Orthographic projection; shades on and shadows cast by—simple solids (rectilinear or of single curvature) and combinations of solids; simple forms of architectural or mechanical details; axis parallel to one of the planes of projection in each case; radial projection of shadows of simple solids, cast upon vertical and horizontal planes by sun or artificial light; shadows cast by solids of double curvature as sphere, hollow sphere, vase, baluster, and cup forms, the sun's rays being in any specified position; shadows received by planes vertical, horizontal, inclined, or oblique, and by surfaces of single or double curvature in any position.

Books recommended for reference:—Dennis' "Third Grade Perspective"; H. Angel's "Practical Geometry (Advanced)"; R. C. Puckett's "Scioigraphy"; Robert Pratt's "Scioigraphy."

The student before entering for this course must produce evidence of having passed the second year's geometry and first year's perspective, or be following those courses; and is also advised to take up the first year in freehand or model drawing.

PLANT DRAWING.

FIRST YEAR.

Drawing in outline from plants, foliage, flowers, &c., from nature, elementary brush work, painting in monochrome in water-colours.

SECOND YEAR.

Drawing and painting in water-colours, Australian and other flowers, plants, shrubs, foliage, &c. Botanical analysis of Australian flowers, plants, &c., for decorative purposes.

This course of instruction is primarily for the benefit of decorators and designers of both sexes, its purpose being to make the student familiar with the combinations both of form and colour to be found in nature, and suggest new motives for conventional treatment.

To obtain a certificate for plant drawing, a student must also obtain a pass in the first year each of freehand, geometry, and design.

STILL LIFE.

FIRST YEAR.

Painting in oil or water-colour, fruit foliage, &c., simple studies in drapery, furniture, pottery, glass, metal-work, &c., compositions, back grounds, &c., necessary to be considered in painting fruit and Still Life pictures.

SECOND YEAR.

Painting in oil or water-colours more advanced studies, including birds, animals, fishes, crustacea, &c.

A student before entering the above class must have passed the second year freehand or model drawing, or be attending those courses.

To obtain a certificate in Still Life painting a student must have passed the first year each in freehand and model drawing, perspective, geometry, and plant drawing.

ANATOMY.

The essential and distinctive characters of the human form. The divisions and regions of the body. The proportions of the normal adult male and female.

The Stationary Figure.—The causes of the reliefs of the surface of the skin mainly to be sought in the subjacent structures—bone, muscle, tendon, fat, and glands.

The Figure in Motion.—The modification of relief consequent, directly or indirectly, on changes of the form of muscles. Elementary exposition of the effects of construction on the form of muscles.

The Skeleton.—Names and connections of the bones, general consideration of skeleton, sexes, races of men, &c. The joints generally, immovable, movable, and mixed.

The Muscle.—The muscular system, structure and action of the muscles, their influence on external form.

Books of Reference :—Marshall's "Anatomy for Artists"; Sparkes' "Artistic Anatomy."

ANTIQUE.

FIRST YEAR.

Drawing in outline from the flat, drawing in outline, heads, busts, hands, feet, &c., from the round, shading in chalk or painting in monochrome either in oil or water-colour. Drawing from memory.

A student before entering this course should have passed the third year freehand drawing, or second year model drawing, or be attending those courses.

SECOND YEAR.

(Sydney only.)

Drawing in outline from round and relief, drawing and shading the whole figure, as Discobolus, Dancing Faun, Venus de Medici, &c. Painting from the full figure in monochrome, either in water-colour, oil or tempera. Drawing complete anatomical figures. Drawing from memory.

In this course students attending the Sydney classes will receive part of their instruction at the National Art Gallery.

To obtain a certificate for the antique a student must have passed in second year freehand and model drawing, first year each of geometry, perspective, and modelling from the antique.

LIFE CLASS.

FIRST YEAR.

Drawing in outline from life, in the nude and draped figure, drawing and shading in chalk or painting in monochrome, either in oil or water-colour, drawing from memory.

SECOND YEAR.

Drawing and shading in chalk, pastels, and oil or water-colours from the nude and draped figure. Studies in drapery, backgrounds, &c. Memory drawing and composition.

In this class students will receive part of their instruction at the Art Gallery, making studies from the old masters in flesh tints, grouping, costumes, &c.

Students before entering the above class must have passed the first year Antique, or be attending that course.

To obtain a certificate in the Life a student must have obtained passes in second year Model Drawing, first year Perspective and Anatomy, third year Freehand, and second year Antique.

LANDSCAPE AND ANIMAL PAINTING.

FIRST YEAR.

Drawing from nature in black and white; painting in monochrome in water colours; sketching from buildings, &c., showing the practical application of linear perspective; studies of rocks, trees, skies, &c.

SECOND YEAR.

Painting direct from nature in oils and water colours; aerial perspective, shadows, reflections; processes and manipulation, as glazing, impasting, scumbling, handling, &c.; copying from the great masters; drawing and painting from animals, &c.; studies of costumes, interiors of buildings, &c.

Students attending the Sydney College will receive part of their course of instruction at the National Art Gallery.

Before entering this class a student must have passed in second year Model, third year Freehand, and first year Perspective.

MODELLING.

MASTER MODELLER'S CERTIFICATE.

FIVE YEARS COURSE.

First Year.

Modelling Ornament, 1st year.
Freehand Drawing, 1st year.
Model Drawing, 1st year.
Geometry, 1st year.

Second Year.

Modelling Ornament, 2nd year.
Casting, 1st year.
Plant Drawing, 1st year.
Design, 1st year.

Third Year.

Modelling Ornament, 3rd year.
Modelling (Antique), 1st year.
Drawing (Antique), 1st year.
Drawing (Life), 1st year.

Fourth Year.

Modelling (Life).
Modelling (Antique), 2nd year.
Drawing (Antique), 2nd year.

Fifth Year.

Modelling (Life).
Casting, 2nd year.
Anatomy (Artistic).

MODELLING (ORNAMENT).

FIRST YEAR.

Modelling tools and their uses; modelling in clay simple symmetrical forms from the cast, and details of free ornament; modelling in clay or wax, fruit, flowers, leaves, &c., from the cast and nature.

The student in going through this course will be taught how to sketch or block out work, also how to manipulate the clay into the required forms with the fingers; modelling tools to be used only where the fingers are impracticable.

SECOND YEAR.

Modelling more advanced forms as complete panels, capitals, friezes, pilasters, string courses, &c. Modelling conventional ornament from the flat, as photographs, &c.; modelling birds, animals, fishes, &c., from the cast. In this year's course the student will be taught light and shade in modelling.

THIRD YEAR.

Copying of advanced ornamentation in all architectural styles from flat copies (plaster casts reference only). Modelling natural foliage, birds, animals, masks, heads, in relief from casts and the flat. Design applied to the modeller's art. Filling in spaces as panels, spandrels, string-courses, friezes, capitals, vases, &c., proportioning of spaces, light and shade, projections, balance of ornament, how to apply natural foliage and conventionality of same suited to design.

The student in going through this course will be made acquainted with all styles of ornamentation and familiar with the purity of natural and conventional forms, simplicity of design, and how to design for all materials. Modelling from the round, as ornament, the human figure, animals, birds, fruit, &c.

The above class is mainly intended for modellers, plasterers, carvers, terra-cotta workers.

To obtain a certificate for Modelling Ornament a student shall pass in Design, Geometry, Plant-drawing, and Casting, each 1st year.

Books of Reference:—Owen Jones' "Grammar of Ornament"; R. N. Wornum's "Analysis of Ornament"; F. W. Moody's "Lectures and Lessons on Art."

MODELLING (ANTIQUE.)**FIRST YEAR.**

Modelling in clay portions of anatomical figures, also hands, feet, eyes, nose, mouth, ears, masks, busts, and other parts of the human figure.

SECOND YEAR.

(Sydney only.)

Modelling complete anatomical figures, modelling the full figures as Discobolus, Germanicus, The Dancing Faun, &c., studies in high and low relief, &c.

To obtain a certificate for Modelling (Antique) a student must also have passed the second year Drawing from the Antique, Anatomy, and the first year Casting.

CASTING CLASS.**FIRST YEAR.**

Casting from waste moulds, gelatine, wax, sulphur, and plaster piece-moulds, moulding and casting simple objects from nature, as fruit, flowers, leaves, &c., casting more difficult subjects, as busts, statuettes, medallions, plaques, mineral specimens, fossils, bones, &c.

SECOND YEAR.

(Sydney only.)

Casting, advanced, from the human figure, hands, feet, human features, and the full figure from life, casting reptiles, fishes, crustacea, &c.

Students are invited to bring specimens for the class.

To obtain a certificate for this class a student must pass the first year each of Freehand and Modelling.

POTTERY.*

FIRST YEAR.

Manufacturing of terra-cotta for art, decorative, and architectural purposes ; clays adapted for terra-cotta—how to prepare them ; washing, drying, and proportioning of materials, grinding and pugging ready for use.

Plaster and clay model-making, plaster mould-making suitable for clay work ; pressing or making of clay objects from moulds, methods of finishing pressed work and drying of same ready for kiln. Practical firing or baking of terra-cotta, the construction of the kiln, how to set objects in oven so as to ensure safe and perfect baking. The different stages of firing ; to know when the wares are of sufficient hardness. The regulation of draught, when and how to fire off kiln.

SECOND YEAR.

Throwing of objects on the potter's wheel, turning and finishing of work on the lathe. Methods of casting models from plaster moulds, such as statuettes, &c. Fixing handles to cups, vases, &c., piecing together portions of models which cannot be made whole and sticking of same. Decorating surfaces of pottery, such as thumb work (imitation Wedgewood), etching and printing, incising or needle-work, slip-lining by brush or tube, filling in lined spaces, glaze decoration. Practical enamelling and glazing, their compounds and uses, how to prepare them, methods of applying enamels and glazes to bodies, unburnt clays, also wares which have previously been fired, termed biscuit, salt glazing. The construction of the muffel or gloss oven, method of setting wares in oven, seaggers and their uses. The principles of firing gloss oven, showing the difference of firing glazed wares to terra cotta, pottery painting, &c.

To obtain a certificate in the above a student must also pass in the first year each of Freehand, Modelling, Design, and Casting.

CHINA PAINTING.

FIRST YEAR.

Painting flowers, birds, &c., on vases, plaques, and table, dessert, or tea ware, in various designs, viz. : The old style of Sevres, Chelsea, and Derby.

Raised gold birds and flowers, coloured and chased.

Painting on coloured grounds with raised enamels and traced with gold. Also all the modern styles of decoration.

SECOND YEAR.

Landscape and figure painting on the glaze. Painting the figure, landscape, birds, flowers, &c., under glaze. Ground laying, painting, and preparing gold to be used on the ware. Crest and monogram painting. Monograms in flowers and in raised gold, chased.

Students' work, when considered of sufficient merit, will be fired at the College. Students may learn to fire their own work if they desire it.

To obtain a certificate for China painting the student must have passed in first year Freehand, Geometrical, Plant-drawing, and Design.

* The class is not actually in operation, but its formation will be considered should a sufficient number of intending students apply.

SYLLABUS

OF THE

DEPARTMENT OF INDUSTRIAL & DECORATIVE ART.

P. W. JOHNSON, Lecturer (in charge of Department).

THE classes in this department are arranged to give instruction in the various branches of decorative art. Students have here an opportunity of gaining instruction useful to them in the particular branch in which they are employed, and also a practical knowledge of other divisions necessary to their advancement.

HOUSE-PAINTING.

TWO YEARS COURSE.

FIRST YEAR.

The various brushes used in painting; how to tie up and prepare a brush; oils, driers, colours, and materials used in painting; method of mixing colours; preparation of colours for various purposes, such as oil-colour, enamel, spirit-colour and distemper, or water-colour; painting of new woodwork, stonework, cement, &c., in oil-colour; flatting and distemper colour; method of painting, cleaning, knotting, priming; stopping putty and its uses; second coat; sand-papering; third or finishing coat; preparation of old woodwork for repainting; burning or cleaning off; priming; filling-in; rubbing down; finishing coats; cleanliness—care of brushes, tins, paint, &c.

SECOND YEAR.

Mixing stains; colour of various woods; preparation, sizing, and finishing; varnishes, and their application to different work; first coat; rubbing down; second coat; sizing and varnishing new woodwork, wall-paper, &c.; paper-hanging tools and their uses; preparation of walls; lining papers; sizing walls; damp walls; hanging paper; setting out dados, friezes, borders, &c. Stencilling—preparation of stencils; various tools required; method of working stencilling in oil, spirit, or distemper colour; use of lining fitch; colouring; arrangement of colours (elementary) for entrance-hall, dining-room, drawing-room, library, bedrooms, &c., in oil, spirit, or distemper colour; exterior colouring.

Students are advised to give two nights per week to each subject following:—

GRAINING AND MARBLING.

TWO YEARS COURSE.

FIRST YEAR.

Various tools and materials used; preparation of the different grounds and colours required to produce them; different colours of oak—light, medium, and dark; mixing and working graining colour or megylyp; combs and combing—fine, medium, and coarse; setting out; treatment of door-panels, stiles, &c.; cleanliness of mouldings and joints; heart of oak, Pollard oak—methods

of producing them; overgraining colours—preparation and execution. Soft woods, maple, satinwood, mahogany, walnut, &c.—the various colours and methods required in their execution.

SECOND YEAR.

Marbling.—Tools and materials used; preparation of grounds; methods of working—oil, scumbling, varnish; execution of white, grey, Sienna, green, red, and black marbles; laying in; finishing; varnishing; rubbing down, &c. Inlaid woods and marbles; preparing ornaments—various methods of production; application to general decorative purposes. Panels—inlaid door, furniture, entrance hall, &c.—maple and walnut, maple and tulip wood, walnut and tulip wood, &c.; Sienna marble and green marble band, Sienna marble and jasper ornaments.

SIGN-WRITING.

TWO YEARS COURSE.

FIRST YEAR.

Preparation of grounds; colours and materials used; colour for general work; oil—dead, sharp, &c.; covering qualities; setting out; use of chalk and line. Letters—various styles; Egyptian, Roman, Italics, &c.; upright, slant, and curved; proportion; spacing; setting out for special purposes; shading—raised, sunk, angular; heightening or thickening; back or off-shadow; gilding—preparation and various kinds of size used for gilding; methods used in its execution.

SECOND YEAR.

Writing, Gilding, and Decoration on Glass.

Methods of setting out and preparing for glasswork; materials used and sizes required for gilding; method of execution; dressing-off and backing-up; blocking letters; thickness and back-shadow—different methods and treatment; harmony of colour in letter, thickness, and ground. Letters—double projection, ornamental letters and tablets for various purposes, church work, various ornamental capitals and alphabets.

ADVANCED CLASS.

ONE YEAR COURSE.

Working plans for ornamental writing and other work to scale; sketch designs in pencil, water-colour, &c.; ornaments best adapted for glass-work; decorative panels in gold and colour for furniture, &c.; glass painting; mirror painting; monograms, ribbons, coats of arms, &c.

In the first year's sign-writing instruction is given in the art of drawing and painting letters; not only for the sign-writer but for the carver, lithographer, map and plan draftsman, ticket-writer, or to any engaged in a craft where letters (or so-called printing or lettering) are used.

DECORATION (ELEMENTARY).

TWO YEARS COURSE.

FIRST YEAR.

Stencils—how to produce and cut them; scroll, corners, centres, breaks, pilaster ornaments, panels; borders—upright, double, running, hanging, &c.; diapers, frieze ornaments; dado and dado-rail, &c.; monochrome or flat ornament; working drawings; different methods of transferring ornament to prepared grounds, as pouncing, tracing, &c.; ornament applied to given spaces.

SECOND YEAR.

Materials, &c., required for decoration. Ornament—relieved or shaded; outlined; etched; its various treatment. Colour—its qualities, combinations, and effects; yellows, reds, blues, browns, greens, &c., as applied to decorative purposes; methods of working ornament in oil, spirit, or distemper colour; treatment of ornaments for frieze, wall; dado and dado-rail, diapers for wall spaces; modern materials used in decoration, and methods of treatment.

ART DECORATION.

TWO YEARS COURSE.

FIRST YEAR.

Working plans; scale; enlargement and reduction; setting out dado, frieze, wall, &c.; height and proportion; ceilings—various treatment; working drawings to scale; colored diagrams or plans for the decoration of private dwellings, churches, public buildings, &c.; decorative plans in various styles for special purposes; bird, flower, animal, and figure panels—their various treatment, as flat, outline, shaded, &c.; decorative treatment of the entrance-hall, drawing-room, dining-room, library, bedroom, &c.; special designs for organs and church work.

SECOND YEAR.

Colour—formation, harmony, discord, primary, secondary, tertiary; hues, tints, shades, &c.; cold colour and warm colour—application to decoration; principles of good taste in choice of wall-papers or other coverings; carpets; window drapery, furniture, &c.; planning and arrangement of rooms; harmony in ceiling, wall, woodwork, drapery furniture and carpets; general effects; decoration for special purposes; designing for wall-papers and other decorative materials.

DESIGN.

TWO YEARS COURSE.

FIRST YEAR.

Primary forms—the straight line in design, simple lines and combination of lines, repetition of lines, continuous lines, curved lines in design, geometrical arrangements, radiation from central line or point, plant forms adapted to design—suggestions from their forms and growth.

SECOND YEAR.

Adapting and applying designs—simplicity and correctness of form, utility and fitness, proportion, harmony, natural forms conventionalised for the purpose of design, in wood, stone, iron, &c., on flat surfaces and on modelled surfaces, symbolic designs, the solid in design, the principles of construction and its enrichment.

Practical lessons will be given in applying principles to the following purposes:—

Designs in iron for hardware, both cast and hammered.

Forms for silversmith's work—raised surfaces and inlaying.

Glass—best forms and their enrichment by cutting and engraving.

Stained glass and its treatment.

Furniture—construction and enrichment.

Decorative ornament—flat and relief.

Carpets, hangings, and textile fabrics—design and colour.

SYLLABUS
OF THE
DEPARTMENT OF DOMESTIC ECONOMY AND COOKERY.

MISS F. FAWCETT STORY, Teacher.

COURSE OF INSTRUCTION.

Elementary Cookery.—Theory and practice in first principles:—

1. The larder.
2. The store-room.
3. How to clean stoves and cooking-utensils.
4. Rules for boiling and stewing.
5. „ roasting and baking.
6. „ frying and broiling.
7. Choice of meats and cooking of joints.
8. Management of stockpot.
9. Simple rules for pastry-making.
10. Boiling and steaming puddings.
11. Vegetables.
12. Management of stoves.

Plain Cookery.

1. Plain family soups and broths.
2. Plain sauces.
3. Savoury and economical dishes of meat.
4. Fish.
5. Dishes made of various pastries.
6. Puddings.
7. Breakfast dishes and beverages.
8. Sick-room cookery.
9. Bread and cakes.
10. Plain sweets and stewed fruits.
11. Réchauffes of cooked meats.
12. Miscellaneous items.

N.B.—This course embraces all dishes ordinarily used in middle-class homes, and includes cookery for the sick.

High-class Cookery.

The entire service for dinner and supper parties. Special lessons given in garnishes. It is proposed during the year to give a special course of demonstrations for the benefit of professional cooks.

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| 1. Trussing poultry, boning, and larding. | 6. Entremets—sweet and savoury. |
| 2. The cooking of poultry, and game. | 7. Entrées. |
| 3. Soups and purées. | 8. Supper dishes and salads. |
| 4. Sauces—hot, cold, store, and sweet. | 9. Jellies and creams. |
| 5. Dressed fish, and fish entrées. | 10. Indian curries and other dishes. |
| | 11. Souffles, omelettes, and fritters. |
| | 12. Garnishes, farces, &c. |
| | 13. Cakes and icing. |

Preserving.

Jam-making.

Fruit-preserving.

Pickles.

Stores, sauces, vinegars, and salad-dressing.

DOMESTIC ECONOMY.*Food.*—Its work, sources, uses, and purchase.*The Home.*—Air; disposal of waste; ventilation; water supply; choice of furniture; methods of cleaning.*Health and Prosperity.*—Common ills, and simple remedies; influence, and conditions of drainage; simple nursing; value of temperance; income and expenditure; thrift.**IRONING CLASS.**

Cold starching.

Ironing shirts and blouses.

LITHOGRAPHY.

A. A. LAWSON, Teacher.

THREE YEARS COURSE.

SYLLABUS.

FIRST YEAR.

Rollers.—Different qualities; their construction; how to prepare for printing; chemical effect on them of inks, varnishes, dryers, turpentine, kerosene, &c.; how to keep in order.

Lithographic and Copper-plate Presses.—Their construction and uses of different parts; effect of any part being out of order.

Lithographic Machines.—Their construction, names and uses of different parts, mechanical principles, effect of any part being out of order, levelling, &c., in laying down, where to look for causes of imperfections in printing, register, &c., use of oil, parts not to be oiled, causes of unequal wear, speed to be driven at, pulleys, cones, belts, &c.

Transferring.—Copper transfers, retransfers, photo-litho. transfer paper, tracing transfer, grained paper, plain paper, transferring to hot, cold, and wet stones.

Rolling-up.—Chalk, ink, stipple, splash, &c., preparing for machine and other purposes.

Set-offs.—Different kinds and mode of making gelatine, ink, dusted, &c.

Etching.—Chalk and other work, chemical action of acids, gums, &c., on the crayon, ink and stone proportions to be used; cause of spots, weak places, and other imperfections, how to restore and preserve for future use.

Printing.—Orders of colour in printing, damping mixtures, setting off of previous printings, chemical action of one colour on another.

Machine Printing.—General principles, setting and levelling of stones, treatment of various descriptions of work.

Drawing on Stone.—Ink, chalk, splash, stipple processes, colour stones, Key's gelatine, tracing paper, &c.

Engraving on Stone.—Preparation of stone, engraving, inking in, &c.

Zincography.—Preparation of plates, etching, transferring, rolling up, printing in machine or press, &c.

SECOND YEAR.

The Lithographic Stone.—Its component parts, different varieties, the reason of its affinity for grease, circumstances under which this is reduced or increased, effects of atmosphere, heat, cold, water, gums, acids, inks, varnishes, resin, &c., on the stone, cause of breakage increased or lessened under different circumstances, modes of levelling, polishing, graining, &c.

Inks.—Their basis, mode of manufacture, how to properly incorporate with varnishes, chemical action of one colour with another when mixed, fast and fugitive colours, effects of adulteration.

Varnishes.—Oils used in their manufacture, mode of preparation, chemical results from mixing with colours, effects of heat or cold, adulteration, &c., various grades, their uses and effects.

Dryers, liquid and dry—necessary proportions to be used, effect of various dryers on inks, cause of ink drying in or glazing on the paper.

Turpentine, kerosene, spongeline, benzole, &c.—their uses and effects on stone, rollers, or wherever applied.

Papers.—Various descriptions used in printing—their component parts, mode of manufacture, uses and effects of enamel, coatings, surfaces, rolling, calendering, causes of stretching, shrinking, creasing, damping, chemical effect and results, adulterations and their effects on printing and colours.

Transfer Papers.—Various descriptions used in their manufacture and uses; chemical actions, with ink, chalks, stone, water, &c.

Transfer Inks.—Plate, retransfer, writing-ink, chalks, their mode of manufacture, causes of their not holding to the stone, smashing or thickening, &c.

Colours.—Natural and manufactured. Their chemical properties; varieties, vegetable, mineral, aniline, &c.; effect of acids in their manufacture on the varnishes, stone-work, and paper; preparation necessary before making into inks.

Bronzes.—Different qualities, grades, &c.; mode of manufacture, uses and manner of uses, cause of their tarnishing, wiping of the paper, proper colours to use in bronze work, and how to make the bronze adhere firmly.

Acids.—Nitric, sulphuric, phosphoric, citric, &c.; their chemical actions and uses.

Water.—Rain, filtered, sea, distilled, &c.; their uses and effects.

Gums.—Different varieties; their chemical actions, uses, and effects.

Collotype Printing.—Preparation of plates; process of printing a nature study; washing and drying the plates; printing; the margins; temperature; damping; preserving the plates.

THIRD YEAR.

Photo-Lithography.

The lens; the camera; notes on light.

Wet Plates.—Preparation of the negative bath; laying the film; exciting the film; exposing the plate; time of exposure; development of the image; fixing the negative; varnishing the negative; defects, their causes and remedies.

Dry Plates.—Exposure; development; fixing.

Printing Processes.—Blue process for copying; tracings, &c.; preparation of the paper; drying; printing; fixing.

Silver Process.—Sensitizing the paper; printing; toning; fixing; washing.

Bromide Printing.—Exposure; development; toning and fixing; defects, their causes and remedies.

Photo-Lithographic Transfers.—Preparation of the transfer paper; inking; cleaning off; drying; transferring to stone.

Platinotype Process.—Preparation of Platinotype Paper, Printing, Development by Hot and Cold Processes, Washing and Mounting.

Enlargements.—Enlarging by daylight and artificial light.

SYLLABUS

OF THE

DRESSCUTTING, DRESSMAKING, AND MILLINERY CLASSES

MADAM KING, Teacher.

THE courses of instruction in these subjects are :—

1. For persons wishing to qualify themselves to become teachers of the art of dressmaking.
2. For those who wish to qualify themselves for positions in houses of business.
3. For those who wish to practise it in their own homes.

Those who wish to obtain a certificate of teacher must attend all the courses, pass the annual examinations, and give satisfactory proof of their ability to teach.

The courses of instruction are as follows :—

Theoretical.—Scientific dress-drafting.

Practical.—The art of dress-cutting, dress-fitting, and dressmaking.

Students will have to provide themselves with a system of dress-drafting, price 16s., obtainable from the teacher. This system is not procurable elsewhere in the Colony, and is for the exclusive use of the student.

First Term.—Measuring and drafting bodices to measurements for any individual; drafting sleeves to measurements; drafting skirts to measurements; altering the drafting to suit any figure and all changes in fashion. At the end of the Term the students will be required to produce a complete set of correct diagrams representative of the work done by them during the term.

Second Term.—Cutting out and fitting on bodices; cutting out and fitting on sleeves; cutting out skirts; cutting out Princess dresses and morning wrappers.

Third Term.—Dressmaking; students using their own material.—Bodices (plain and trimmed); sleeves (plain and trimmed); Princess dresses, &c.; how to cut various materials (plain and fancy), velvet, plush, crape, &c.

Art Millinery.—The course will include hat and bonnet making; children and infants' millinery; making of lace caps; hat and bonnet trimming; copying from any design.

SYLLABUS
OF THE
DEPARTMENT OF MANUAL TRAINING.

Teachers.

Training College, Fort-street...	...	...	}	WM. POWRIE.
Model Public School, Fort-street	..	...
Sydney Technical College	...	..	...	JAMES DUNLOP.
Crown-street Superior Public School	...	...	}	HENRY GALE.
Blackfriars	..	...
Sussex-street Public School	..	...
Maitland District	..	...	...	FELIX COLES.
Goulburn District	...	..	...	T. A. WILKIE.
Newcastle District	...	...	...	W. E. JONES.

MANUAL TRAINING.

STUDENTS OF THE TRAINING COLLEGE.

SYLLABUS.

ONE YEAR.

Elementary Solid Geometry and Mechanical Drawing—(*Vide* Solid Geometry, First Year).

Timber.—Names and peculiarities of the different kinds of timber, principally grown in New South Wales; growth, composition, age, when to fell, season to fell, natural and artificial means of seasoning, cutting up for economy and beauty, decay of timber and common modes of preservation, measuring and selection.

Tools.—The names, shape, and construction of the principal hand-tools for working in wood; how to grind, sharpen, and keep them in order.

Saws.—The names and peculiarities of the different kinds of saws; set, shape of teeth, hook, cutting edge of teeth, and how to sharpen them.

Dressing timber truly, testing it with winding sticks, and square; chamfering, setting out work, halving, mortising and tenoning, scarfing, preparing and using glue; nails and screws, and exercises in driving them; making small boxes, small mitred frame, Oxford frame, &c.

MANUAL TRAINING.

PUBLIC SCHOOL COURSE.

FIRST YEAR.

Drawing.—The uses of set-squares and compasses; the principles of projection. Definitions of the following terms:—Plan, elevation, section, projector, horizontal plane, vertical plane, XY or ground line. Drawing to scale and full size (from models with the aid of set-squares, &c.), exercises for practice.

Tools.—The construction and uses of the following:—The common rule, saws, planes, chisels, gouges, hammer, mallet, try-square, spokeshave, gauges, &c., their manipulation and how to keep them in order; grinding and sharpening angles of edge tools for hard and soft woods.

Practical Work.

Exercise I. Dressing timber truly; the use of plane, try-square, winding sticks, and marking gauge.

II. The use of saw and chisel, also chamfering.

III. Square prism, planing, sawing, and paring with chisel.

IV. Octagon prism; the use of chisel, plane, and pencil gauge.

V. Cylinder, the use of plane.

VI. Paper-knife, to show varying grain in wood.

VII. Grooving, chamfering, cutting flute and V.

VIII. Shield, the use of plane, gauge, spokeshave, bow-saw, and compass.

IX. Grooving, rebating, chamfering, working ovolo and scotia.

X. Soap-tray, fitting, and the use of nails.

XI. Lapped halving.

XII. Oxford frame, lapped halving applied, rebating, and stop chamfering.

XIII. Towel-roller.—Exercise V applied.

SECOND YEAR.

Drawing.—More advanced drawing, including plans, elevations, sections, and isometric projections.

Timbers.—Names, peculiarities, and uses of the common timbers grown in New South Wales.

Practical Work.

Exercise I. Housed joint.

II. Tongue and groove joint.

III. Wall-bracket—housing applied; cutting curve and chamfering.

IV. Mortise and tenon joint.

V. Haunched mortise and tenon joint.

VI. Mortise and tenon frame—common and haunched mortise and tenon joint applied; rebating, chamfering, and the uses of glue.

VII. Rail for clothes-hooks, inlaying with different coloured woods.

VIII. Mitre joint.

IX. Parquetry mat.

X. Common dovetail joint.

XI. Lapped dovetail joint.

THIRD YEAR.

Drawing.—Making working drawings from models and sketches; sketching the different joints used in woodwork; making dimension sketches from objects and diagrams.

Timbers.—Names and uses of the common timbers used in New South Wales; growth, age, and season to fell timbers; natural and artificial methods of seasoning, cutting up for economy and beauty; decay of timbers and common modes of preservation.

Practical Work.

Exercise I. Inkstand.

II. Dovetailed box—common dovetail applied; fixing hinges and driving screws.

III. Book-rack—lapped dovetail applied.

IV. Wall-bracket—mortise and tenon applied; fret cutting and carving.

V. Chess-board, inlaying and veneering with different coloured woods—mitre joint applied.

SYLLABUS

OF THE

COAL-MINING CLASSES.

JON. MAY, Certificated Colliery Manager (First Class), Teacher, Newcastle District.

SYLLABUS of Course of Instruction for Certificate in Coal-mining. Two Years Course.

FIRST YEAR.

FIRST TERM.

Geology.—General outlines; physiographic; lithologic; historic and dynamic; origin and classification of rocks; fossilisation; inclination of strata; faults; conformable and unconformable strata; order of succession; flora and fauna; principal coal-fields of Europe, America, and Australia; composition and varieties; commercial value of coal; patent fuel.

Boring.—Searching for coal; preliminary considerations; prospecting; choice of site; boring; appliances used; chisels; rods; guides; instruments for clearing; spring pole and other manual methods; difficulties of deep boring; special methods; application of machinery to; Mather and Platt's diamond boring; Chinese system; American system; Cremorne and other deep bores; cost of boring.

Sinking.—Position; form and size of shafts; mode of getting to stone head; pile-driving; "drums," wood; iron; "back-casing"; keeping shaft vertical; lining shafts; bricks; iron "tubbing"; curbs; water; walling; tubbing; supporting, "tubbing off" water; coffering; concrete; wood; iron; strength of tubbing; cost; prevention of corrosion; sinking by special methods; Lippman's; Kind-Chaudron; quicksand methods; Trigger's; Poetsch's; drainage arrangements; explosive compounds; electric blasting apparatus; drilling by compressed air.

SECOND TERM.

Methods of Working Coal.—Timbering main roads for top, bottom, or side weight, by timber, iron, masonry; modes of working; two principal systems; bord and pillar; long wall; first bord and pillar; size of pillars; main road and barrier pillar; common pillars; laying out of mine; separate districts; separate ventilation of districts; splitting of air currents; modification of bord and pillar; long wall; distance apart of gateways; cutting off gateways; size of pack; working steep measures; thick seam; South Staffordshire methods; square work.

Haulage.—Primitive methods; skips; body frame; carrying capacity; horses; comparative cost with machinery; self-acting incline; drums; pulleys; clip and "V" pulleys; transmission of power; hydraulic; compressed air; wire rope; electricity; direct haulage; main and tail rope; endless rope; "C" pulleys; Barraclough's and other clip pulleys; clutches for branches; general principles of friction clutches; modes of attachment; clips; automatic detachment; underground locomotives—compressed air and electric; size and arrangement of engines.

THIRD TERM.

Winding.—Pulley frames; structural design and position of "back stays"; wood; iron; comparative cost; pulleys; cages, methods of construction; catches; ropes; wire rope; steel; iron; hemp; taking off strain; conductors; wood, iron, and wire rope; winding engine; foundation; engine pillar; counterbalancing load; primitive and modern methods; pneumatic system; overwinding; detaching hooks; "keeps"; signalling—electric and ordinary; indicators.

Pumping.—Bucket, plunger pumps, and winding by kibbles; shaft arrangements for lift-pump; plunger pump; method of securing pipes in shaft.

Guides.—Counterbalancing; connection to rods; pump clacks; suspended lifts for sinking; strength of pipes and spear rods; air vessels; Davey's differential engine; Cornish pumping engine; direct-acting steam pumps—Tangye's; Worthington's; Moore's hydraulic pump; pulsometer; electricity; pump arrangements for sinking; size and power of pumps; syphon-lift pump; dams, brick, concrete, timber, and clay.

SECOND YEAR.

FIRST TERM.

Ventilation.—Importance; gases generated in mines; after damp; coal dust; general properties; production of air current; natural and artificial; by furnace; steam jet; mechanical ventilators; Guibal Waddle; Schiele, Capell, and other fans; general principles of displacement and centrifugal; "Walker's shutter"—arrangements of engine for driving fan; laws governing the circulation of air in mines; splitting the air; benefits and limits.

Air Current.—Distribution of the air; stoppings; door regulators; air crossings; to reduce loss in circulation; quantity required per given number of men for gaseous and non-gaseous mines; measurement of air currents; primitive methods; deflection of flame; powder smoke; pressure and temperature; chemistry of mine gases; diffusion and general composition.

Lighting.—Naked lights; safety lamps—Clanny, Davy, Stephenson, Mueseler—general design; modern lamps; locks; lead and magnetic; electric lamp and light; primary and secondary batteries; gas indicators—Lieving; Pieters; Ashworth; Clowes.

SECOND TERM.

Surface Arrangements.—Size, position, and type of appliances for ventilating; winding, pumping, and other machinery; boilers; mechanical stokers; coating steam pipes; workshops; laying out of surface plant and the erection of colliery headgear and heapstead.

Screening and Dressing of Coal.—General ideas; “kick-up,” double, and triple skips; screens; revolving and shaking screens; belts; revolving tables; loading shoots at wharf.

Washing and Sizing.—Luhrigg’s; Robinson’s; Berard and Coppee’s washing arrangements; coke-making; bye-products; ammonia.

THIRD TERM.

Mining Machinery and General Mechanics.—Mechanical powers; strength of materials; hydraulics; force; work; horse-power; efficiency of machines; lever wheel and axle; transmission of motion by pulleys; inclined plane; winding machinery; mechanical ventilators; pumping machinery; hydraulic, electric, and compressed air motors.

Coal-mines Act.—Regulations *re* employment; wages; single shafts; division of mine into parts; manager’s duties; inspection; general and special rules; special rules at leading collieries.

BOOKS OF REFERENCE.

GEOLOGY.—Lyall, Page, Geikie.

MECHANICS.—Cryer and Jordan, Goodeve, Jamieson.

SURVEYING.—Brough and Fenwick.

VENTILATION.—J. J. Atkinson, W. Fairley, William Tate.

PRACTICAL MINING.—Pamely, Wardle, Smythe, Hopton, Collins, André, Hughes, Merri-vale, Callon’s Lectures, Lupton, Tate.

SYLLABUS

OF THE

COURSE OF INSTRUCTION IN MINE SURVEYING.

ARCHIBALD GARDINER, Teacher, Newcastle.

FIRST YEAR.

Explanation of Terms.—General principles and importance of mine surveying; mineral deposits; mining terms; measures of length; angular measures.

Measurement of Distances.—The chain; chaining on slopes; offsets; obstacles of measurement; measurement of bases by the chain, rods; steel bands; measuring wheels; paling; accuracy of linear measurements.

Various Forms of Miners' Compasses.—The Hedley, Henderson's Davis, Whitelaw's, Thornton's, White's, Eddie's, and Webber's; their construction and method of working them; the tripod, ball socket, Hoffman's joint, and other late improvements; the spirit level; the needle; the earth's magnetism; the variation of the compass needle; the determination of the true meridian; influence of iron, steel, haulage ropes, and skips; local attraction in mines; errors in miners' compass surveys; the vernier and principle of it; traversing with fixed needle; doubling bearing system.

Various Forms of Booking.—For surface surveys; underground surveys; levelling underground and surface; with theodolite, compass, and level.

Theodolite.—Description of its principles, construction, and method of using it; for measuring horizontal and vertical angles; its use in mines; the comparison of theodolite and compass.

Surface Surveys.—The principle of; triangulation; geometrical constructions; logarithms, trigonometry, and their uses; theorems and solutions for computing the several parts of triangles.

Office Work.—Paper and its treatment; scales; instruments; plotting; co-ordinates; traverse tables; computing areas; balancing the work; double distances and areas; computing areas and finding content of solids; coal-fields, railway cuttings, embankments, and capacity of reservoirs or dams.

Levelling.—Definition and principles; various systems; instruments; their adjustments; level staff, for underground and surface; bench marks; datum line; preparation of paper for plotting a section; the use and value of cross sections.

Setting out of Works.—Ranging out straight lines; curves, with and without a theodolite; engine plane sections and curves; simple mining problems.

SECOND YEAR.

This will include an advanced step of First Year's Course.

To make an underground survey; plot it at class, check the work by co-ordinates.

Make a surface survey; plot and check angles trigonometrically.

Make a section; plot it; draw contour lines on plan.

Make calculation from section and cross-sections.

Draw out on paper and on field a railway curve.

Calculate capacity of a reservoir to find volume of water; of a coal-field with troubles, &c.

Preservation of plans; practical hints on mine plans; copying; tracing; pricking a plan through; enlarging and reducing plans from one scale to another.

More advanced mining problems.

REGULATIONS.

1. Students should pay their fees to the Registrar before attending the classes. The receipts are to be presented to the teachers, who will enter their names on the class-rolls. No fees can be returned.
2. Students joining the classes during the first seven weeks of each term are required to pay full fees, and for the remaining seven weeks or portion thereof, half fees.
3. Students are expected to be punctual and regular in attendance, orderly in behaviour, and not to leave the class till the roll has been called.
4. Students provide their own special tools.
5. Students should not displace any of the models, books, or portfolios belonging to the College, except by the consent of the Lecturer, Teacher, or Assistant in charge.
6. Any person damaging models, books, &c., will be held responsible for payment for replacing or renewing the same.
7. Teachers are authorized to suspend disorderly students from attendance, such action to be subject to the approval of the Superintendent; and Students so suspended will not be readmitted to the class until they furnish a satisfactory explanation or apology.
8. Students will not be admitted to the workshops or class-rooms outside of the hours allotted for instruction, except by special permission.
9. All receipts for fees are issued to students subject to these regulations.
10. Teachers are expected to be present in the class-room at least five minutes before the time for commencing the lesson.
11. Teachers prevented from meeting their classes are required, if possible, to find a competent substitute, and to report, without delay, to the Superintendent the cause of absence and the arrangements made.
12. Teachers requiring leave of absence for more than one day must make application for leave to the Minister of Public Instruction, through the Superintendent, in time for proper arrangements to be made for conducting their classes.
13. All cases or presses having locks or fastenings should be secured at the close of the lesson by the Teacher in charge, who is responsible for all apparatus, &c., provided for use in the class.
14. The Teacher of each class is required to keep an accurate record of the attendances, and to furnish promptly such returns as may be directed by the Superintendent.
15. All requisitions for materials, &c., for the use of the classes, must be made out in duplicate on the printed forms, and forwarded to the Superintendent.
16. The works of Students produced in the College or Branch Schools shall be regarded as the property of the Department of Public Instruction as long as these works are required for examination or exhibition purposes.
17. Students are advised to provide themselves with lecture-note and home-work books. These should be carefully written up, and presented periodically to the Teachers for examination.

EXAMINATIONS.

1. The Annual Examinations are held during the month of December.
2. A student who holds a certificate in any grade will not be awarded a second certificate in that grade.
3. The following marks must be obtained to pass in the undermentioned grades:—85 per cent. of marks (honors); 75 per cent. of marks (first grade); 50 per cent. of marks (second grade).
4. The Minister of Public Instruction has decided that certificates issued to Public School Teachers and Pupil Teachers by the Technical Education Branch in the undermentioned subjects exempt the holders from further examinations in such subjects:—
 Physics, Chemistry, Geology, Botany, Physiology.
 Freehand Drawing (second year)—any grade—for Teachers and Pupil Teachers.
 Model Drawing (first year)—any grade; Perspective (first year)—any grade—Section 1.
 Geometrical Drawing (first year)—any grade.
5. Students are not eligible for examination in any subject unless they have actually attended classes in that subject for at least two whole terms during the year in which they sit for examination.
6. Prizes are awarded to Students who obtain honours; provided they have attended the classes three full terms in the year in which they are examined, and have not previously passed in the subject.

NOTES.

1. The terms of the Sydney Technical College and Branch Schools are as under:—First Term, 8th February to 15th May; Second Term, 17th May to 21st August; Third Term, 23rd August to 27th November.
2. The Technological Examinations of the City and Guilds of London Institute for the advancement of Technical Education are held in Sydney, Granville, Bathurst, Goulburn, Newcastle, and Maitland during the month of April in each year.
3. Text-books.—Books recommended by the Teachers may be procured from Angus and Robertson, 89, Castlereagh-street; Turner and Henderson, 16 and 18, Hunter street; George Robertson and Co., 363, George-street; W. Dymock, 428, George-street; and other booksellers.
4. Drawings for transmission to the Science and Art Department of Great Britain for classification by its Examiners are selected by Lecturers in charge of Departments at Sydney Technical College at the end of February in each year.
5. Vacation begins 20th December, 1897, and ends 5th February, 1898.
6. No classes are held on Public Holidays, and on Thursday evening prior to Good Friday.

LANTERN SLIDES.

Lantern slides will be lent to Public School Teachers on the following conditions:—

1. That their safe return within the specified time be guaranteed.
2. That the applicant arranges for the transmission of slides and pay the expenses incurred.
3. That damage of any kind be made good by the applicant.

REGULATIONS FOR CERTIFICATES, DIPLOMAS, ASSOCIATESHIPS, AND FELLOWSHIPS.

THE ANNUAL EXAMINATIONS ARE HELD IN DECEMBER.

(Special Examinations for Wool-sorters are held between the months of March and July.
See Wool Department Syllabus.)

CERTIFICATES.

Certificates are awarded to students who attend the classes and pass the required examinations for the complete course; for parts of a course intermediate certificates are issued.

DIPLOMAS.

Diplomas are awarded to students who have obtained the certificates in any Department, and have passed the final examination in the principal subjects in the First Grade.

ASSOCIATESHIPS.

The title of Associate of the Sydney Technical College is conferred upon any student who passes the final examinations in the principal subject with Honors. Associates may attend any course of lectures free of charge.

FELLOWSHIPS.

The Fellowship of the Sydney Technical College will be conferred upon those who, having obtained the Associateship, shall have spent not less than six years in actual practice, and shall have done some original and valuable research work, or have contributed to the advancement of the industry in which they are engaged.

THE TECHNICAL COLLEGE LIBRARY.

The Library at the Technical College is open without charge to teachers and students daily from 9 to 11 a.m., 1 to 4.30 p.m., and from 6 to 9 o'clock in the evenings. It contains a large number of books of a technical or general character, as well as most of the current periodicals, such as *The Scientific American*, *The Builder*, *Engineering*, *The Engineer*, *The Sanitary Record*, *Nature*, *The Journal of Decorative Art*, &c., &c. At present the Library is one of reference only. The text-books prescribed in the Calendar will be found in the Library.

FARES—TRAM AND RAIL.

1. Attention is called to the following concessions granted by the Railway Commissioners:—

- (a) Tram.—Students are allowed to travel to and from class on the tramways at half fares. Special tickets can be purchased at the Tramway Ticket Office, Redfern Railway Station, or at the Central Booking Office, George-street, on presentation of the Special College Certificate, duly signed.

RAIL.—REDUCED RATES FOR STUDENTS ATTENDING TECHNICAL CLASSES.

- (b) Students of the Technical Colleges will be allowed return tickets at half-fares on the days of the week they attend classes. A certificate of class membership, properly signed (procurable on application at Technical College Office), must be handed to the booking clerk each time the concession is required.
- (c) Students of Agricultural or Technical College when travelling from Sydney on Saturdays or public holidays for field instruction will be allowed return tickets at half the ordinary fare, on being identified by the Instructor in Agriculture.

Tickets at half single fares for the double journey (available for return for two months) will be issued to School Pupils not in any employment or in receipt of wages, not exceeding 16 years of age, and at half Holiday Excursion Fares to Pupils exceeding 16 years of age, returning home for or travelling during recognized school holidays, viz., Easter, Midwinter, Michaelmas, and Christmas, or when travelling for the purpose of examination, competing with other schools in athletic sports, or visiting the Museum or Zoological Gardens, Sydney, on production of certificates to the Station-master at the station nearest the school, from the master or mistress of the school, tutor, or governess, on the accompanying form:—

"I certify that _____ aged _____ is one of my
pupils, and is returning home, &c."*

Address and name of school. (Signed)

* Or as the case may be.

These tickets are not issued from suburban stations to Sydney.

Printed forms can be obtained on application to the Central or Redfern Booking Offices, Sydney, and at the principal stations on the Southern, Western, or Northern Lines.

Tickets at similar rates will be issued to University Students and Students of the Technical College, not in any employment or in receipt of wages, when travelling during vacation, on production of a certificate from the Principal of the University, or from the Superintendent, as the case may be, in the following form:—

“ is a Student at the University of Sydney (or
Agricultural or Technical College), years of age, who is now
about to travel to during vacation.
(Signed) ”

Tickets at these rates will also be allowed to students of the Technical College in the classes for instruction in matters affecting sheep and wool when travelling to sheep shows in the country. Certificates must be presented from the Superintendent, Technical College.

TECHNOLOGICAL MUSEUM, SYDNEY.

Assistant Curator : R. T. BAKER, F.L.S.

Office hours, 9 a.m. to 4.30 p.m., Monday to Friday; 9 a.m. to 12 noon, Saturday.

Telephone No. 1,558.

It is open to the public during every afternoon of the year (except Good Friday and Christmas Day),—Week days, 1 to 5 p.m., Sundays, 2 to 5 p.m.

Students of the Technical College and visitors non-resident in Sydney and suburbs are admitted during the mornings also, on signing their names in a register kept for the purpose. The Assistant Curator is also glad to see persons in search of information during the mornings (should they choose to come at that time), whether they are resident in Sydney or not.

The Museum has been removed from the temporary premises at the Agricultural Hall, Outer Domain, and is now situated in Harris-street, Ultimo, within five minutes' walk of Redfern Railway Station. It contains considerably over 10,000 specimens, is a bureau of information in regard to the raw products and manufactures of New South Wales, and visitors are advised as to probable sources of information, provided requirements cannot be satisfied at the Museum. The new Museum was opened on 4th August, 1893, by his Excellency the Governor, Sir Robert Duff, G.C.M.G. The new building rises to a height of 75 feet, and is 183 feet long by 50 feet wide. The style adopted corresponds with that of the Technical College, being an attempt to adapt the spirit of Romanesque to the necessities and materials of the present day. There are three main floors 15 feet high, divided transversely into bays 16 feet wide, which, while providing separate compartments to facilitate the classification of the exhibits into groups, and simplifying the study by visitors of the different kinds of specimens, afford an amount of wall space (on the cross-partitions) for the exhibition of diagrams, &c. The amount of floor-space on each floor is 9,150 square feet and of wall space 6,000 feet, making in all 27,450 feet and 18,000 feet respectively.

The ground floor is devoted to economic geology, together with metallurgy, art metalwork, and casts in plaster of various objects of applied art. In the south end of this floor are placed the greater portion of the heavy iron and steel specimens, illustrating both in size and quality the material required for various works. The ores of iron and iron minerals are here, while in one case are exhibited specimens of meteoric iron and models of meteorites. Models of furnaces used in the manufacture of iron and steel are also shown in this bay. In the next one are various models of engineering work and machinery, while two tested armour plates, 9 in. thick, of wrought iron, one faced and the other unfaced with steel, are placed at the entrance of this

bay, together with models of steam hammers. In the bay opposite are collections of particular interest to the engineer, architect, and others dealing with materials of construction. A complete set of tested specimens is shown in two large cases, giving at the same time all the information required in calculating the strength of the principal materials used in building and machine construction. The specimens are of steel and iron of all kinds, copper alloys, bronze, wood, and various kinds of stone, and have been tested by thrusting, shearing, twisting, pulling and bending stresses. Here are also sets illustrating all the stages in the manufacture of various steel goods. The next bay is devoted to art metal work, grouped as far as possible to represent the production of various countries. A complete set (reproduced from the originals) of the celebrated Hildesheim Treasure, found in 1868 near the town of that name in Germany, is here shown. The originals were in silver and gold, and give an insight into the articles used, and the mode of decoration employed in the manufacture of this class of articles by the Greek or Roman artists. In the Japanese collection, several specimens of the celebrated cloisonné ware, together with articles illustrating the various stages of its manufacture, are shown, also miscellaneous specimens of metal work from Japan. Bay No. 19 is devoted to fictiles, or reproductions in plaster of various art objects. The next bay is devoted to the display of sets illustrating the material and processes employed in the manufacture of glass and pottery. Passing eastward one finds two bays, which are devoted principally to models and furnaces used in the manufacture of pottery and bricks. The next bay is devoted to pottery, and, together with the cases in the main passage opposite, contains some very fine specimens. A set in a case near the door illustrates the manufacture of pottery at Doulton's, of Burslem, Staffordshire. This contains some exquisite vases presented by the firm, and especially interesting because the ornamentation consists of Australian native flowers. Bay No. 15 contains specimens of building and ornamental stones used in the construction of public and other buildings in various parts of the world, specimens used in the construction of the various cathedrals of Europe being prominent. Bay No. 14 is devoted to rocks, consisting of specimens of sandstone, limestone, granite, diorite, dolerite, &c. Bay No. 13 is devoted to the exhibition of specimens illustrating phenomenal geology, together with sets of rocks, minerals, fossils, &c., for teaching purposes. The end of this floor toward Pymont is used as a research laboratory and workroom, where specimens are tested and prepared previous to exhibition. The geological, mineralogical, and chemical library is also located in this part of the building. The side of the ground floor nearest to the college is devoted principally to mineralogy, sets to illustrate the physical properties of minerals, crystallography, &c., being placed in six cases, occupying the end bay. The next bay contains ten showcases devoted to quartz and its varieties, gems and precious stones, the various kinds of anhydrous and hydrous silicates, asbestos, and substances used in grinding and polishing. The next is the carbon bay, and contains all the varieties of carbon and hydrocarbons, with peat, lignite, and other substances, as well as coal, used for lighting and heating purposes. Bay No. 7 is devoted to calcium, barium, strontium, magnesium, sodium, potassium, and lithium minerals. Bay No. 5 is devoted to gold, silver, lead, and mercury ores, and models of furnaces for the extraction of the metals from their ores. Copper ores are found in the next bay, with models of furnaces used in the smelting of these ores. Bay No. 3 contains arsenic, antimony, tin, bismuth, zinc, nickel, cobalt ores, and the ores of the rare metals. Marble, granite, and serpentine columns decorate the ground floor, and are surmounted with vases of similar materials.

On the first floor are grouped in their respective courts or bays the economic products of the vegetable kingdom, and also in juxtaposition models, diagrams, and appliances illustrative of them. The number of bays is twenty-two, and eight of these are given up to timber specimens. Timber from many parts of the world is to be found here. Artistic specimens of carving in colonial wood are among the exhibits, and at the entrance of the different bays are large slabs of rosewood, beech, black bean, teak, cedar, and other woods, standing out as indisputable evidence of the colony's wealth in timbers. Bay No. 18 forms a botanical court. There are freshly-culled specimens of our indigenous flora, or wild plants, in neat vases, and labelled according to natural orders, genus, and species. Thirty-eight cases in bay No. 5 are crowded with specimens of hemp, jute, flax, sisal, ramie, esparto, and a multitude of other vegetable fibres. Wattle barks form the chief features of bay No. 6. Every specimen has its popular and botanical name attached with the locality where grown, and in addition, on a separate label, are shown the results of chemical analyses made in the museum. In bay No. 8 are models of wine-making apparatus used in the south of Europe, and other agricultural implements. Bay No. 9 contains cases of pulses; maize, wheat, and other cereals. Bay No. 10 contains starches, spices, and condiments, narcotic beverages, and Australian native foods. Bay No. 12 is devoted to seeds and fruits of Australian plants. Bay No. 14 contains seven cases of carpological specimens, one of perfumes and four of oils.

Bay No. 4, on the second floor, contains a collection of leather, which, includes a very fine tanned hide of a crocodile from North Australia, and a skin of the black whale, rough tanned, and Bay 5 contains a fine set of educational engineering models. Bay 6 is almost filled with a large show case containing a set of models of flying machines. Bay 7 contains the ethnological collection, which is limited to the weapons and dress of Australian natives and those of the South Seas. Bay 8 is set apart for animal products useful to man. Bay 9 comprises many insect productions, including appliances connected with bees and bee-keeping. Bay 10 contains Kindergarten appliances, samples of work done by the blind, needlework, &c. Bays 11 and 12 comprise the educational court. Bay 13 contains a printer's press and other appliances for working a small printing establishment. Bay 14 is devoted to silk, and contains collections of raw and manufactured silk, cocoons, and silkworm moths from all parts of the world. Bay 15 embraces marine products. Bay 16 contains various models. Bay 17 has its walls covered with views of modern Sydney, and some very interesting views of Sydney in 1810. Bay 18 contains sanitary appliances.

The wool section is one of the most important features of the museum, and embraces an extensive collection of representative wools from almost every country. The collection contains 7,000 specimens of raw wool from the very classic stud rams and ewes, flock sheep, and wools in all stages of manufacture, and are arranged in courts.

Local museums on the plan of the central Technological Museum in Sydney, have been established at Albury, Goulburn, Bathurst, Newcastle, and West Maitland, and a special feature in each is the prominence given to the raw and manufactured products of each district.

The whole of the specimens, &c., belonging to the Technical Education Branch are for the furtherance of technical education in New South Wales, and are in distinct buildings, partly because of the exigencies of accommodation, and partly because of the requirements of the teaching staff. The collections are for two chief purposes, which, although broadly distinct, have no sharp line of demarcation between them: first, the display of more

or less complete series in museums for the general public; and secondly, the provision of "mobile" collections to suit the varying requirements of teachers for purposes of illustration.

The fusion of the collections in the central Museum and in the Technical College is already complete, and lecturers have the resources of a well-stocked technological museum to draw upon, the specimens of which, wherever practicable, are transferred to the class-rooms for longer or shorter periods, and where the specimens cannot be so transferred, owing to difficulties of transit, special facilities are granted to students for the examination of specimens in the Museum itself.

Testing Machine.—Timbers, bricks, stone, and other structural materials are tested for the public at the testing machine in the Sydney Technical College. Particulars may be had on application to the Curator.

Colonial Timbers.—Colonial timbers whose properties are imperfectly or entirely unknown will be tested in the pattern, carpentry, or other workshops free of charge, with the view to bring out their probable useful applications. Consignments of timber should not be sent until after a preliminary report from the Curator on each application.

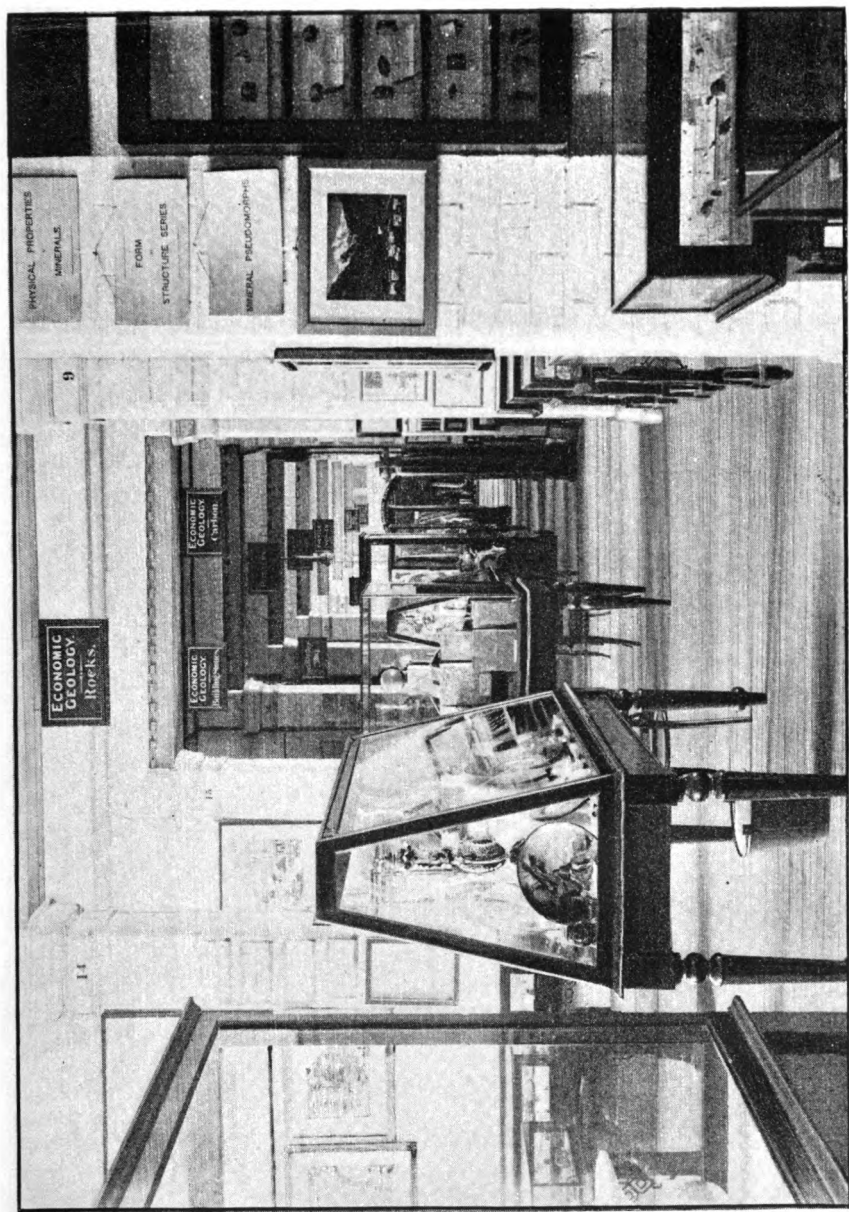
Collection of Specimens.—A pamphlet entitled "Hints for the Collection and Preservation of Raw Products suitable for Technological Museums," 2nd edition (see page 7); has been issued, and may be had free on application. It is particularly intended for country residents who are desirous of supplementing the collections in the local and central museums.

Catalogues of Wool Specimens.—Descriptive catalogues of the extensive collection of raw wools and specimens to illustrate woollen manufactures in the Museum have been issued. They are on view in the Museum, and are in use in the Wool-sorting and Agricultural classes at the Technical College. A few copies remain, and are on sale at one shilling each. They are issued annually; the fourth is now nearly ready.

The Minister of Public Instruction is desirous of drawing the attention of Australian wool-growers to the Wool Department in this Museum, and he cordially invites inspection. The object of the collection being the furtherance of the great wool industry of the Colonies, it is arranged solely for referential and educational purposes.

The collections in the central Museum at Sydney, and the local Museums at Bathurst, Goulburn, Newcastle, and West Maitland, already contain over 7,000 specimens of wool and hair from various quarters of the world, and include specimens from most of the leading flocks of Australasia. Under these circumstances, and to make the series as complete as possible, the Minister appeals to wool-growers to contribute specimens of every variety of their wools. The samples should be 6 oz. or over in weight, and accompanied in each case with particulars of pedigree, breed, age, brand, &c. A report on each sample will be prepared by the Museum wool-expert, and a copy sent to the donor where desired.

The New South Wales Railway Commissioners have kindly granted free carriage to specimens of all kinds intended for the museums, but require preliminary notice of the stations between which carriage is desired, and the date. This notice may be supplied by donors direct to local Station Master, or the notification may be made to the local Science Masters in the towns already mentioned, or to the Curator of the Technological Museum, Sydney. Any forwarding expenses incurred by donors residing in the neighbouring Colonies will be paid by the Minister.



GROUND FLOOR, TECHNOLOGICAL MUSEUM.

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TILDEN FOUNDATIONS

The following hints are given in regard to the various kinds of useful products obtained from plants, and may be useful as a guide to beginners as to the way to treat specimens :—

TIMBERS.

Timbers should only be gathered, wherever possible, during the autumn or winter, as then the sap is least active. When it is borne in mind that unless the identity of a timber be established it is of no use as a reference specimen, and can probably be only available for firewood, the following precautions will not be deemed superfluous, inasmuch as it is usually a more serious matter to transport a log of timber than any other specimen of economic botany.

If the tree be in flower or fruit, or both, twigs bearing each should be taken, pressed in the usual manner, and numbers *fastened* to them corresponding to numbers on the logs.

If no flowers and fruit be available, another tree of the same species growing near should be marked, in order that flowers and fruit may be obtained from it at the proper season.

Do not choose a tree of abnormal diameter, as (even if considerations of carriage do not enter into the calculations) it frequently happens that such trees are unsound at the centre.

Having decided upon the tree, fill in the required information in the schedule. (*Appendix B.*) The height and diameter of course can be given after the tree is felled, but it is also desirable to obtain the heights and diameters of a few other trees of the species for purposes of reference. Approximately correct estimates of the heights of trees can be obtained by experience, and I know no simple aid to this end which is applicable both to hilly and flat ground, and always capable of application.

Most persons will over-estimate the height, and to give only approximate correctness requires considerable experience. On a sunny day the following is a simple method, giving sufficiently exact results for the purpose: Cut a stick a few inches longer than (say) 4 or 6 feet, so that when stuck or driven into the ground 4 or 6 feet are clear above ground; measure the length of the shadow which the stick throws, and note the proportion of length of shadow to length of stick. Then measure the shadow of the tree under observation, when from the length of the shadow the height of the tree can be found, making of course allowance for any inclination the tree may have. The inclination of the tree may often also be imitated by the stick.

The diameters can of course be found by passing a string or tape-measure round the trunk, and dividing by three.

Felling.—It will usually be found desirable to fell the tree by means of a crosscut saw, unless the tree be very small; and if two men be requisite to cut down the tree the probability is that not less than this number will be required to lift it on to the drey for carting away.

Care should be taken not to damage the bark unnecessarily. In most cases it will be sufficient to put a band of hoop-iron inside each cut; but where the bark is very foliaceous—*e.g.*, some *Melaleucas* and *Persoonias*—canvas should be tightly bound round the log before it is cut from the tree.

Transit.—It is desirable, though not always necessary, to stitch logs tightly in canvas before despatch to their destination. In two cases it certainly is indispensable—first, when the bark is so readily separable that it cannot be handled without removal; and, secondly, where the bark is aromatic—*e.g.*, *Sassafras*, as in that case the temptation to country people to peel it off is very great; and this has happened more than once in my experience—rope should be tacked, garter fashion, on both ends of a log. The log can roll on this without damaging the bark, and the timber will escape with a minimum of concussion.

Labelling.—A collector in the bush always endeavours to carry as little weight with him as possible, but, if possible, he should *paint* both ends of the log with legible numbers corresponding to those in the schedules.

The next best method is to affix luggage labels (or labels made out of leather) in duplicate, one tied to each rope. The probability is that *both* will not be lost. Another method, not so good, is to tack the label to the bark; but this is always more or less insecure, and with some barks impossible.

Size of Timbers.—Those in the Technological Museum are cut to a uniform size of 4 feet. The logs should be, therefore, cut 4 feet 6 inches to allow for trimming and accidents. Slabs or hand specimens for the show-cases are made of three sizes, viz., 2 feet, 1 foot, and 6 inches long. These vary in width, and are 1 to 2 inches thick. It is often possible to get such specimens when the procuring of logs is out of the question.

Exhibition.—Large logs in the Museum are sent to the sawmill when they are deemed to be sufficiently seasoned. No general rule as to time necessary for seasoning of timber can be laid down, as this has to be learnt by experience. A log receives one longitudinal cut, dividing it into halves. It is not desirable to expose these fresh surfaces too much

Collecting Materials.—The following are desirable articles to take with one on plant-hunting excursions :—

- (a) A tin box to string across the shoulders, and to open easily—a flap-lid is very convenient—and inside this a narrow band of zinc may be soldered to slip in :—
- (b) A trowel, which should preferably be long, narrow, stout, and bright,

We also require—

- (c) A small lidded tin canister, such as a mustard tin, or a lunch tin, for holding the smallest and most delicate plants.
- (d) A pad of blotting paper (little wire ventilated frames for holding these pads are sold and are very convenient), for pressing *at once* plants or flowers which wither immediately.

Although the above are desirable parts of the equipment, yet it is possible for most or every article to be dispensed with in many cases.

Modus operandi.—*Trees and Shrubs.*—Snip off a small flowering twig. In this and all other cases get well expanded flowers if possible (partly expanded ones, or buds, if the fully-opened flowers be not available). Get fruits also, if possible, and do not remove the leaves of flowers from them for fear of destroying or casting a doubt upon their identity.

“By their fruits ye shall know them” might have been written for the particular edification of the botanists. It is often impossible to name plants without their fruits. In many cases we can name them from fruits when we cannot give the species from flowers only. Especially is this the case with gum-trees (*Eucalyptus*). On these trees fruits, old or young, can usually be found. I cannot lay too much emphasis on this matter of fruits.

Small Plants.—Dig these up by the roots with a trowel, and then shake away the earth carefully without damaging the roots. Many plants have tubers; they require great care to bring up with the plant. In the case of small plants, it is always desirable to have them complete for the herbarium, though where a plant is rare, or supposed to be, it is expedient and considerate to leave the roots in the ground to prevent its extermination.

The flowers or fruits of some plants drop off immediately the plant is handled. Note should be made of this, and a few flowers or fruits gathered.

Drying Materials—Requisites.—

A few quires of blotting paper, or grocers' paper (such as is used for wrapping up sugar). Where this is not convenient, sheets of soft newspaper will do excellently. Plants are often sent to me between pages of the *Sydney Mail* or *Town and Country Journal*, and if other newspapers be used, the sheets should be cut to about the size of pages of these journals. In fact newspaper is sometimes preferable to ordinary drying paper to travellers, whose time and opportunities are limited, for two reasons :

1. Drying paper is more or less hygroscopic.
 2. It is heavy, and objectionable on that score.
- (b) Two or more fairly thick boards of the size of the sheets of paper. Cedar is the best, owing to its lightness.
 - (c) Means of applying pressure to the sheets of paper. Buckled straps or carpenters' screws answer well.

It is convenient to have all the above in duplicate, *i.e.*, a large set of the size above mentioned, and a smaller set, say of the size of a double sheet of note-paper, for the separate drying of small and delicate plants.

Modus operandi.—As soon as convenient after the excursion, the specimens should be dried. They should be spread out on a table and arranged in order of thickness. One of the pressing-boards is laid on the table and six or a dozen sheets of the drying paper (which should be perfectly dry through having been recently exposed to the sun or to a fire, if necessary) placed on the board to form a pad. A layer of plants is placed on this. The great thing to bear in mind is to secure evenness of pressure, and therefore of drying, and this can only be done by spreading the plants well over the paper and maintaining the thickness as evenly as possible. One or two sheets are placed on these plants and the operation repeated a number of times, always arranging the plants in such a manner that the topmost layer is fairly horizontal. It is perhaps only necessary to insist on this, and then leave the detail to one's common sense.

The layers of paper and plants should not be continued until the heap is higher than eight or ten inches. The packing of the plants will be so conducted that the thickness of them increases towards the top of the heap. Then a dozen sheets of the paper are added. On this a board is placed which is weighted evenly, or else the upper and under boards are strapped or screwed together.

The papers will require changing every day for the first three days, and every other day for another four or six days. The length of time requisite for pressing the plants can only be learnt by experience, and of course depends on two things—the state of the atmosphere with respect to moisture, and the nature of the plants themselves, whether succulent or the reverse. It will be desirable to have a duplicate set of drying papers in order that while one set is in use the other set may be thoroughly dried.

Thick specimens, obviously too large to be dried in this way, are usually dried by being hung on a line. Specimens dried in this way are, however, much more untidy-looking when finished than those which are dried by pressure, as the leaves, &c., are free to assume any shape in the former case.

In cases where there are no opportunities for properly preparing specimens, or because the name of a plant is required immediately, simply roll the plant in a piece of newspaper and send it by post just as it is.

When out in the field, the collector of economic botany for this Museum uses a pair of light cedar boards with a pair of loose straps—not fastened permanently to the boards. The specimens are under pressure *at once*, the moment they are put between the boards out in the field. The pressure can be gradually and suitably adjusted. The boards can be put on edge, or even hung up suspended free, *which allows the moisture to escape more freely* than when placed flat under a press. In this way, also, any dry wind can immediately be taken advantage of while the specimens are pressing. The best results are usually obtained when *dry cold winds* are blowing. Heat should be avoided as much as possible, for when the moisture escaping from the specimens becomes heated, fermentation is set up more or less, and the specimens are apt to become discoloured.

Instead of the cedar boards, a few sheets of grocers' paper (or newspaper) contained between a pair of pieces of cardboard of the same size, and the whole kept together with elastic bands, will answer the purposes of most people.

The specimens require now to be labelled and mounted before being placed in the herbarium.

I have found it a most convenient practice to label each specimen immediately it has been dried, and here is a copy of the label I have adopted :—

No.	
Bot. Name	
Local do.	
Nat. Ord.	
Whence obtained	
By whom	Date

Such a label (written or printed on very thin paper), is placed on each specimen, and fixed to it by means of a thin strip of gummed paper enclosing the specimen, and fastened to the back of the label.

If a batch of specimens be collected on the same date from the same locality it will obviously be convenient to multiply the label by one of the processes usually adopted for making fac-similes.

The locality should be stated as fully as convenient, in order that a plant shall be the more readily traced should it be desirable, for any reason, to obtain a further supply of

The specimens are now ready for mounting.

It will be well to give thoughtful consideration to the size of the paper it is proposed to use for the mounting of the specimens, for uniformity is desirable for appearance sake, to say nothing of the convenience of storage, either in parcels or boxes. The size should neither be too small nor too large. Perhaps a sheet of demy is the best, taking all circumstances into consideration. When folded into two this will give us a space of about $11\frac{1}{2}$ in. x. $17\frac{1}{2}$ in. for mounting the specimens upon.

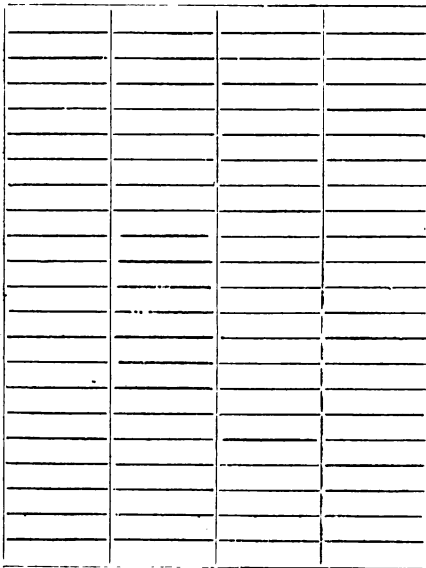
The size having been decided on, grocer's paper will be found to answer every purpose. Some people use cardboard, but its lack of flexibility frequently causes the plants (often very brittle when dry) to break away.

Mounting.—The plant is placed in the middle of the paper and fastened down with strips of gummed paper. The paper forming the margin of a sheet of postage stamps will suffice, unless the perforations offend the sense of neatness, when gummed paper made from a very thin tough hand-made paper, can be procured at the shops, and strips cut to any width and length. Stalks, petioles, fruits, &c., can be kept in position by a little hot glue, and setting can be assisted by a paper weight.

Preserving.—*Dry.*—The herbarium must be kept in a thoroughly dry and airy place. The slightest trace of moisture, or want of proper ventilation, will sooner or later be fatal to the collections. A pinch of naphthalene with each specimen will be found an excellent preventive against insect pests. All plants should every now and then be opened out and "aired," unless they are constantly being referred to. Painting each specimen with a solution of corrosive sublimate in spirit effectually keeps away insects, and, at the same time, prevents fermentation of the plants. This is to be recommended to anyone who can afford time for the operation.

Requisites.

- (a) Brown paper for covering all the species of a genus.
- (b) Wooden lidded boxes, a little larger in size than the paper on which the plants are mounted. Cardboard boxes may be substituted if expense be an object. These boxes should be about 4 inches deep, and to slide easily in the partitions of the frame (c).
- (c) A frame to contain the boxes (b). The accompanying figure will show at once the style of thing required. Its pigeon-holes are intended to contain the boxes (b).



The plants of all the species of one genus may now be tied together, bound with brown paper, and the name of the genus written outside.

All the genera of one natural order may be placed in one box.

A large trunk or box will be less expensive than this arrangement, but of course not so convenient. Boot trunks are used by some botanists, but metal trunks are best for storage, if the expense does not stand in the way.

APPENDIX B.

COPIES of the accompanying Form will be sent, on application at any of the Museums, to persons willing to assist in collecting the Vegetable Products of their Districts. Information for filling up *any* of the columns is desirable.

Stock-book Number.	Botanical Name.	Vernacular Name.	Whence Obtained.	Part of Plant (bark, timber, &c.)	Further particulars, including (1) diameter of stem 3 ft. from ground ; (2) part of plant whence specimen obtained ; (3) usual height of tree.	Date of Collection.	Geological Formation.

Communications may be addressed to any of the undermentioned officers of this Branch:—

R. N. Morris,	Superintendent of Technical Education,	Sydney.
W. J. C. Ross,	Resident Lecturer, Technical College,	Bathurst.
A. J. Sach,	do	do
John Pentecost,	do	do
J. A. Hollings,	do	do
		Goulburn.
		Newcastle.
		West Maitland.

[Six photos.]

Sydney : William Applegate Gullick, Government Printer.—1897.

